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Motronic Injection and Ignition System (4 cyl.)>06.96

Engine ID	ADR	AEB							
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Edition 06.1996

List of Workshop Manual Repair GroupsList of Workshop Manual
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Audi A4 1995 ➤

Motronic Injection and Ignition System (4 cyl.)>06.96

Repair Group

01 - Self-diagnosis

24 - Mixture preparation, Injection

28 - Ignition system



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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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01 - Self-diagnosis

1 - Motronic self-diagnosis

1.1 - Motronic self-diagnosis

1.2 - Technical data of self-diagnosis

- ◆ Non-volatile memory
voltage supply independent

Data output:

- ◆ Rapid data transfer

Functions:

- ◆ Check control unit version
- ◆ Interrogate fault memory
- ◆ Final control diagnosis
- ◆ Perform basic setting of engine
- ◆ Read measured value block

Fitting locations of components

- ◆ =>Page 50

After evaluation of the data, the Motronic control unit differentiates between 46 different faults => Fault Table Page 5 .

Notes:

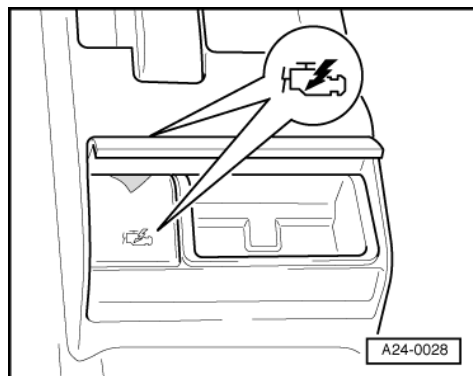
- ◆ The final control diagnosis can only be performed with the engine stopped and the ignition switched on.
- ◆ However, interrogation of fault memory should be performed with the engine running, if possible.
- ◆ The possibilities offered by the self-diagnosis can only be utilised with fault reader V.A.G 1551 or V.A.G 1552. In Repair Group 01, only mode 1 - Rapid data transfer - is described.

Notes on fault recognition and remedy

- ◆ If a fault situation exists for longer than a specific period, the fault is stored as a static fault. If the fault is no longer present after a specified period, it becomes a sporadic fault. This process is constantly repeated. If the fault does not occur within the next 50 engine starts, this sporadic fault will be automatically deleted.
- ◆ By disconnecting the plug from the Motronic control unit, the permanent positive power supply is also cut off and the learned values are thus deleted. This does not delete the fault memory.
- ◆ If a fault recognised by the self-diagnosis is rectified, then carry out the following steps:
 - Delete fault memory.
 - Switch off engine and restart.
 - Carry out a test drive.
 - Perform automatic test sequence by entering address word 00.



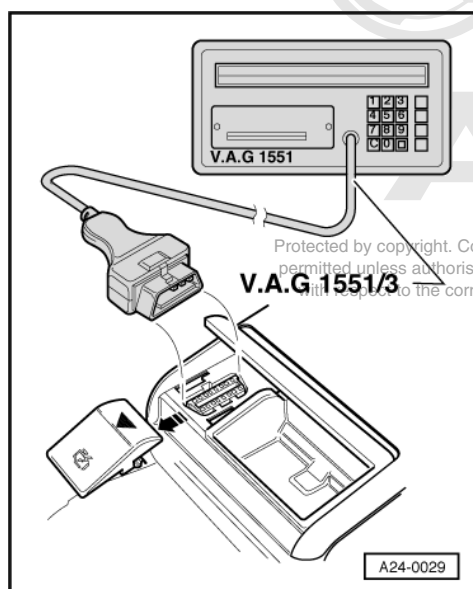
1.3 - Connecting fault reader V.A.G 1551 and selecting functions



Preconditions:

Voltage supply and engine fuses OK

- -> Open rear ashtray (centre console) and remove cover for diagnostic connector.



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- -> Connect fault reader to diagnostic connector with diagnostic lead V.A.G 1551/3.

-> Display:

```
V.A.G self-diagnosis      HELP
1 - Rapid data transfer*
2 - Flash code output*
```

*) Displays appear alternately

- If there is no readout on the display, check the voltage supply according to the faultfinding program for diagnostic lines in the "Current flow diagrams, Electrical fault-finding and fitting locations" binder.
- Switch ignition on.
- Switch on printer with PRINT key (indicator lamp in key illuminates).
- Press key 1 for "Rapid data transfer" mode.

-> Display:

```
Rapid data transfer      HELP
Enter address word XX
```

Note:

When the address word 00 has been entered and confirmed with the Q button, an automatic test sequence is implemented (fault memory interrogation of all systems with rapid data transfer).

- Press keys 0 and 1
(01 is used to enter the address word "Engine electronics")

-> Display:

Rapid data transfer Q
01 - Engine electronics

- Confirm entry with Q key.

-> Display:

Rapid data transfer
Tester sends address word 01

-> If one of these messages appears on the display then perform faultfinding according to the faultfinding program for diagnostic lines in the "Current flow diagrams, Electrical fault-finding and fitting locations" binder.

Rapid data transfer HELP
Control unit not responding!

or

Rapid data transfer HELP
Communications problem

or

Rapid data transfer HELP
K-wire not switching to ground

or

Rapid data transfer HELP
K-wire not switching to positive

The control unit identification and the coding appear in the display.

-> Engine code letters ADP

8D0937557B 1.6L R42V MOTR HS D02
Coding 04001 WSC 00000

-> Engine code letters ADR

8D0907557A 1.8L R4/5V MOTR HS D02
Coding 04001 WSC 00000

-> Engine code letters AEB

8D0907557 1.8L R4/5VT MOTR HS D02
Coding 04001 WSC 00000

- ◆ 8DO : Control unit number (see also spare parts list)
- ◆ 1.6l or 1.8l: Engine capacity
- ◆ R42V: In-line engine, 4-cylinder, 2-valve



- R4/5V: In-line engine, 4-cylinder, 5-valve
- R4/5VT: In-line engine, 4-cylinder, 5-valve, turbocharged
- ♦ MOTR: Motronic
- ♦ HS: Manual gearbox
- AT: Automatic gearbox
- ♦ D . . : Control unit data status (software version)

1.4 - Interrogating and erasing fault memory

- Connect V.A.G 1551 fault reader =>Page 2 .

-> Display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 2
(02 is used to select the function "Interrogate fault memory")

-> Display:

Rapid data transfer Q
02 - Interrogate fault memory

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- Confirm entry with Q key.

-> The display shows the number of stored faults or "No fault detected".

X faults detected

Notes:

No fault detected

- ♦ The stored faults are displayed and printed in sequence when the printer is switched on.
- ♦ If the printer is switched off then the =>key should be pressed to display the next fault.

- After the last fault has been displayed press the => key.

Note:

If a problem persists that has not been detected by the self-diagnosis, continue with faultfinding according to the Problems table from the "Engine fault-finding" binder.

-> Display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 5
(05 is used to select the function "Delete fault memory")

-> Display:

Rapid data transfer Q
05 - Delete fault memory

- Confirm entry with Q key.

-> If this display appears:

Important!
Fault memory has not been interrogated

If the ignition is switched off between interrogating the fault memory and deleting the fault memory, then the fault memory will not be deleted.

- Adhere strictly to operating sequence i.e. first interrogate fault memory.

-> Display:

Rapid data transfer
 Fault memory has been deleted

- Press =>key

-> Display:

Rapid data transfer HELP
 Select function XX

- Eliminate faults listed on printout as per fault table =>Page 5 .
- After rectifying the fault(s), interrogate the fault memory again and delete it to make sure that any faults stored in the mean time (e.g. due to disconnecting plugs) are cleared.
- Switch off engine and restart.
- Perform test drive for at least 10 minutes.
- Perform automatic test sequence by entering address word 00.

1.5 - Fault table

The following table (arranged by fault code number) lists all the faults which the engine control unit-J220 can recognise and which can be printed out on the V.A.G 1551 printer.

If a fault occurs only occasionally or if the fault memory is not deleted after the repair has been carried out, the fault will appear on the display as a "sporadically occurring fault" (SP).

If defective components are detected also check wiring to the components for short and open circuits using with the current flow diagram.

Before rectifying faults or replacing components, check the ground connections of the Motronic control unit -J220, contacts D11 and D12, as well as E11 and E12 (specified values: 0...0.5 ω) and check the ground connections on the engine for corrosion and damage and test the fuel pump relay=>Page 63 .

1.6 - Fault codes 00515 - 01251

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00515 Hall sender -G40 *Short to ground	- Short to ground in Hall sender -G40 or in wiring connection between -G40 and -J220 - Hall sender defective - Signal input in control unit defective (-J220 defective)	- No engine power at full throttle - Emissions not OK - High fuel consumption - Restriction of boost pressure (only engine code letters AEB)	- Test Hall sender => Page 113 - Rectify short circuit according to current flow diagram



V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
*Open circuit or short circuit to positive	- Open circuit or short circuit to positive in signal wire between -G40 and Motronic control unit - Distributor position rotated (engine code letters ADP only) - Hall sender defective - Signal input in control unit defective (-J220 defective)	- No engine power at full throttle - Emissions not OK - High fuel consumption - Restriction of boost pressure (only engine code letters AEB)	- Test Hall sender => Page 98 (engine code letters AEB only)

*) One of these fault types appears in addition to the affected component.

Engine code AEB only

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00528 Altitude sender -F96 * Signal too large	- Open circuit or short circuit to positive in signal wire between -F96 and Motronic control unit -J220 - Altitude sensor defective	- The control unit uses a pressure substitute value of around 750 mbar (approx. 2500 m), - Start-up mixture is too lean at low altitudes, possibly the engine is reluctant to start	- Test the altitude sender => Page 84
* Signal too small	- Short to ground in signal wire from -F96 to Motronic control unit -J220 - Break in voltage supply to altitude sender - Altitude sensor defective	- Restriction of boost pressure for safety restriction of turbocharger turbine speed	- Test the altitude sender => Page 84

*) One of these fault types appears in addition to the affected component.

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00532 Supply voltage * Signal too large	- Supply voltage greater than 16 V - Alternator defective - Excess voltage from assisted start	- Destruction of Motronic control unit -J220	- Test voltage - Read measured value block, - =>Page 29 (Display group 03, Display zone 2)
* Signal too small	- Supply voltage less than 10 V - Poor ground connection to Motronic control unit - Battery discharged - Current drain with ignition off - Fuse -S32 defective	- Engine will not run - (voltage below approx. 6 V) - Idling speed outside specified range - Adaptation for throttle valve control part cannot be performed	- Test battery charge status - Test voltage supply of Motronic control unit =>Page 29 (Display group 03, Display zone 2) - Test fuse -S32

*) One of these fault types appears in addition to the affected component.

Notes on fault code 00532:

- ♦ If the fault is shown as a sporadic fault, ignore the fault message on the display. The fault "Signal too small" may be stored if the engine is run for a long time at idle speed with a lot of electrical consumers switched on, causing the battery to become very discharged.
- ♦ The fault message "Signal too low" is stored if the supply voltage falls below 10 V for more than 2 second. (The control unit will not function at less than 6.5 V.)

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00543 Maximum engine speed exceeded	- Engine over revving (e.g. wrong gear engaged)	- possible engine damage	- eliminate mechanical damage

Note on fault code 00543:

This fault is set if the following engine speed is exceeded:

- Engine code ADP: 6800 rpm
- Engine codes ADR and AEB: 7100 rpm

Engine code AEB only:

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00544 Maximum boost pressure exceeded	- Mechanical boost pressure control valve sticking in closed position - Boost pressure control solenoid valve -N75 not closing (breather on intake side constantly open) - Short to ground in wiring between -N75 and Motronic control unit -J220 (valve constantly fully actuated) - Control line (high-pressure line) from turbocharger to boost pressure control solenoid valve -N75 leaking, disconnected or blocked - Loss of pressure after the turbocharger	- Restriction of boost pressure (boost pressure control goes to fixed value duty cycle of 5%) - Overrun fuel shut-off until boost pressure drops to uncritical value	- Test boost pressure control => Page 71 - Test intake lines between turbocharger and engine for leaks

Note on fault code 00544:

The boost pressure is not measured using a sensor, and instead is calculated from the volume of air throughput, depending on intake air temperature, altitude and engine speed.

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00561 Mixture adaptation *Adaptation limit (add) exceeded *Adaptation limit (mul) exceeded	- Fuel system pressure too low - Incorrect signal from air mass meter - Leaks in the exhaust system upstream of the oxygen sensor - Unmetered air downstream of air mass meter - Coked injectors	- Jolting may occur - Increased fuel consumption - Possibly poor idling, jolting - Restriction of boost pressure (only AEB engine)	- Refuel the vehicle, Check the system pressure - Check the air mass meter - Eliminate leaks - Check injection quantity => Page 59



V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
*Adaptation limit (add) not reached *Adaptation limit (mul) not reached	- Fuel system pressure too low - Incorrect signal from air mass meter - Fuel in oil due to short journey driving style - Injectors leaking - AEB engine only - Leaks in intake system downstream of turbo-charger (air measured by air mass meter escaping)	- Jolting may occur - Increased fuel consumption - Possibly poor idling, jolting - Formation of black smoke - Soot deposits on spark plugs - Restriction of boost pressure (AEB engine only)	- Check system pressure - Test air mass meter - Road test, approx. 15 min. or oil change - Check injectors => Page 33

*) One of these fault types appears in addition to the affected component.

Notes on fault code 00561:

add = additive - The effective of the fault (e.g. unmetered air) decreases as the engine speed increases.

mul = multiplicative - The effective of the fault (e.g. injector fault) increases as the engine speed increases.

Engine code AEB only:

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00575 Intake manifold pressure * Control limit not reached	Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorized by Audi AG. All rights reserved. Copyright by AUDI AG. - Signal from air mass meter too small (contact problem, contact resistance) - Unmetered air between air mass meter and turbocharger	- Increased power	- Check air mass meter => Page 81 - Check air intake hoses/pipe-work
	- Mechanical boost pressure control valve sticking in open position - Solenoid valve for boost pressure control; open circuit, plug disconnected, valve stuck in closed position or breather blocked	- Loss of power	- Test boost pressure control => Page 71
* Control limit exceeded	- Signal from air mass meter much too large - Mechanical boost pressure control valve sticking in closed or partially closed position or sluggish - Boost pressure control solenoid valve not closing (breather to intake side permanently open or partially open or leaking)	- Loss of power - Increased power	- Check air mass meter => Page 81 - Test boost pressure control => Page 71

*) One of these fault types appears in addition.

Notes on fault code 00575:

If the control limit is not reached then this means that the required air throughput is not achieved.

The system tries to achieve the air throughput by increasing the boost pressure.

Engine code AEB only:

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00635 Lambda probe heater upstream of catalytic converter * Short to ground * Short to positive * Output open	- Short circuit to ground in control wire from lambda probe heater -Z19 to Motronic control unit -J220 - Short circuit to positive in control wire from lambda probe heater -Z19 to Motronic control unit -J220 - Open circuit in control wire from lambda probe heater -Z19 to Motronic control unit -J220 - Open circuit in voltage supply for lambda probe heater -Z19	- Emissions not OK - Lambda control switches to open loop control (probe voltage constant, does not fluctuate)	- Test lambda probe heater => Page 32

*) One of these fault types appears in addition to the affected component.

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00670 Throttle valve positioner sender -G127 * Signal too small Signal too high * Implausible signal	- Signal wire from sender to Motronic control unit - short to ground - Wire to voltage supply of sender - short to ground - Signal wire from sender to Motronic control unit - open circuit or short to positive - Sender defective - Open circuit in voltage supply of sender - Positioner mechanism sticking - Throttle valve sticking - Fault in the wiring for the servo motor - Basic setting of throttle valve control part not performed	- Idling speed positioner deactivated - engine idles with a mechanically regulated air flow through the emergency running slot (slightly increased idling speed) - Load change jolt on accelerator release - Air conditioner compressor does not cut in until about 2000 rpm	- Perform basic setting of throttle valve control part => Page 73

*) One of these fault types appears in addition to the affected component.

Notes on fault code 00670:

The sender for the throttle valve positioner is located in the J338 throttle valve -control part.

The sender is a potentiometer which sends information about the position of the throttle valve positioner to the control part.



Vehicles with automatic gearbox only

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
01119 Gear detection signal * Open circuit / short to positive	- The signal for the engaged gear is detected during start-up.	- Brief and slightly more pronounced engine speed fluctuations when engaging or disengaging a gear	- Interrogate fault memory for gearbox - Test wiring connection to gearbox control unit according to current flow diagram
*Short to ground	- The Motronic control unit detects that no gear is engaged (selector lever in P or N), but the signal for retardation of the ignition angle is still detected (gearbox intervention)		

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*) One of these fault types appears in addition to the affected component.

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
01247 Activated charcoal filter solenoid valve *Short to ground *Short to positive	- Short to ground between activated charcoal filter solenoid valve -N80 and Motronic control unit -J220	- Possibility of jolting in part throttle range	- Check solenoid valve for activated charcoal filter =>Page 36 - Check fuse -S29
* Output open	- Short to positive between activated charcoal filter solenoid valve -N80 and Motronic control unit -J220	- Car may smell of petrol	
	- Open circuit between activated charcoal filter solenoid valve -N80 and Motronic control unit -J220 - Fuse -S29 defective - Open circuit in voltage supply to solenoid valve - S29		

*) One of these fault types appears in addition to the affected component.

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
01249 Injector, cylinder 1 -N30 *Short to ground *Short to positive	- Short to ground in control wire from injector to Motronic control unit -J220	- Engine idles roughly or cuts out	- Test fuse -S34 - Check injectors => Page 61
* Output open	- Short to positive in control wire from injector to Motronic control unit -J220		
	- Open circuit in control wire from injector to Motronic control unit -J220 - Fuse -S34 defective - Open circuit between injector and fuse -S34 (voltage supply)		

*) One of these fault types appears in addition to the affected component.

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
01250 Injector, cylinder 2 -N31 *Short to ground *Short to positive * Output open	- Short to ground in control wire from injector to Motronic control unit -J220 - Short to positive in control wire from injector to Motronic control unit -J220 - Open circuit in control wire from injector to Motronic control unit - J220 - Fuse -S34 defective - Open circuit between injector and fuse -S34 (voltage supply)	- Engine idles roughly or cuts out	- Test fuse -S34 - Check injectors => Page 61

*) One of these fault types appears in addition to the affected component.

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
01251 Injector, cylinder 3 -N32 *Short to ground *Short to positive * Output open	- Short to ground in control wire from injector to Motronic control unit -J220 - Short to positive in control wire from injector to Motronic control unit -J220 - Open circuit in control wire from injector to Motronic control unit - J220 - Fuse -S34 defective - Open circuit between injector and fuse -S34 (voltage supply)	- Engine idles roughly or cuts out	- Test fuse -S34 - Check injectors => Page 61

*) One of these fault types appears in addition to the affected component.

1.7 - Fault codes 01252 - 18020

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
01252 Injector, cylinder 4 -N33 *Short to ground *Short to positive * Output open	- Short to ground in control wire from injector to Motronic control unit -J220 - Short to positive in control wire from injector to Motronic control unit -J220 - Open circuit in control wire from injector to Motronic control unit - J220 - Fuse -S34 defective - Open circuit between injector and fuse -S34 (voltage supply)	- Engine idles roughly or cuts out	- Test fuse -S34 - Check injectors => Page 61

*) One of these fault types appears in addition to the affected component.



V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
01259 Fuel pump relay -J17 * Open circuit/short circuit to ground	- Short to ground or open circuit between fuel pump relay and Motronic control unit -J220 - Fuel pump relay defective	- For open circuit: Engine will not run - For short to ground: Engine runs normally, but there is a higher current consumption when the ignition is on, as the relay is permanently actuated and the fuel pump runs constantly, even though the engine is not running	- Test fuel pump relay => Page 63 - Rectify open circuit or short circuit according to the current flow diagram
*Short to positive	- Short to positive between fuel pump relay and Motronic control unit -J220	- Engine will not run	

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*) One of these fault types appears in addition to the affected component.

Engine code AEB only:

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
01262 Boost pressure control solenoid valve -N75 *Short to ground *Short to positive	- Short to ground between boost pressure control solenoid valve -N75 and Motronic control unit -J220 - Short to positive between boost pressure control solenoid valve -N75 and Motronic control unit -J220 - Open circuit between boost pressure control solenoid valve -N75 and Motronic control unit -J220 - Fuse -S29 defective - Open circuit between solenoid valve and fuse -S29 (voltage supply)	- Increased boost pressure (fault 00544 is set as a follow-on fault) - Boost pressure too low - Loss of power	- Check fuse -S29 - Test boost pressure control solenoid valve => Page 71

*) One of these fault types appears in addition to the affected component.

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
16486 Air mass meter signal too small	- Open circuit between air mass meter and -J220 - Short to positive or ground in signal wire to -J220 - Air mass meter defective	- Emergency running mode (substitute value from throttle valve angle and engine speed), thus no noticeable effect on engine running - Restriction of boost pressure (AEB engine only)	- Rectify short or open circuit according to the current flow diagram - Test air mass meter =>Page 81 - Read measured value block,- Display group 02 =>Page
16487 Air mass meter signal too large	- Signal input in control unit defective (-J220 defective)		

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
16496 Intake air temperature Signal too low	- Open circuit between intake air temperature sender -G42 and -J220 - Short to positive or ground in signal wire to -J220	- Emergency running mode (substitute value: fixed + 20 °C)	- Rectify short or open circuit according to the current flow diagram - Test intake air temperature sender - =>Page 29
16497 Intake air temperature Signal too high	- Intake air temperature sender -G42 defective - Signal input in control unit defective (-J220 defective)		

Note on fault codes 16496 and 16497 (engine code AEB only):

As soon as one of the two faults relating to intake temperature is detected the control unit assumes a fixed substitute value of 20°C. This substitute value is not displayed in the 'Read measured value block' function.

In the event of an open circuit in the wiring or the sender the value -46.5°C is displayed.

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
16500 Coolant temperature plausibility	- Open circuit between intake air temperature sender -G62 and -J220 - Short to ground or positive in wiring connection between temperature sender and -J220	- Engine running problems when warm	- Check coolant temperature sender - =>Page 109 - Rectify short or open circuit according to the current flow diagram
16501 Coolant temperature Signal too low	- Contact resistances at plug connections of sender or control unit - Coolant temperature sender -G62 defective		
16502 Coolant temperature Signal too high	- Moisture in temperature sender connector - Signal input in control unit defective (-J220 defective)		

Note on Fault code 16500:

The temperature curve in the range up from 20 °C to 60°C is compared to a model curve stored in the control unit. The rate of rise of the model curve is slower than the actual value. If the actual values become too slow on account of a fault, they will eventually coincide with the model values. This is not plausible.

Note on fault codes 16500, 16501 and 16502:

As soon as one of the faults is identified, the control unit uses first of all a substitute value formed from the model curve stored in the control unit. After a certain time a fixed substitute value is assumed for an engine at operating temperature. ADP engine 75 °C, ADR and AEB engine 60 °C.

In the event of a fault the substitute value is displayed in the Measured value block, Display group 03.

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
16505 Plausibility of throttle valve potentiometer	- Moisture or corrosion - in plug connection at potentiometer - Potentiometer defective	- Slight misfiring under acceleration - Idling speed control behaviour unstable - Load change jolt on accelerator release - Restriction of boost pressure (AEB engine only)	- Check throttle valve control part=>Page 73



V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
16506 Throttle valve potentiometer: signal too small	- Short to ground in potentiometer or in wiring connection between potentiometer and -J220	- Slight misfiring under acceleration - Load change jolt on accelerator release - Restriction of boost pressure (AEB engine only)	- Rectify short circuit according to current flow diagram
16507 Throttle valve potentiometer: signal too large	- Open circuit or short to positive in potentiometer or in wiring connection between potentiometer and -J220	- Slight misfiring under acceleration - Load change jolt on accelerator release - Restriction of boost pressure (AEB engine only)	- Eliminate open circuit or short circuit according to the current flow diagram

Note on Fault code 16505:

The air throughput (air mass) at the relevant speed is compared with the throttle angle.

Note on fault codes 16505, 16506 and 16507:

- As soon as one of the faults is detected the control unit uses a substitute value formed from the engine speed.

- If a fault occurs simultaneously on the throttle valve potentiometer and the air mass meter then the emergency running mode is not available - the engine stalls.

- On AEB engines full-load detection is not possible - excessively high exhaust gas temperature at high loads and high engine speeds (risk

of turbocharger overload).

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
16514 B1-S1 malfunction	- Short between lambda probe signal wire and reference ground - Amplitude of signal voltage too small	- Emissions not OK - Increased fuel consumption - Soot on spark plugs - Lambda control switches to open loop control	- Rectify open circuit or short circuit according to the current flow diagram - Check lambda control =>Page 41
16515 B1-S1 voltage too small	- Lambda probe defective (dirty) - Short to ground or short to screening in signal wire	- Instable idling	
16516 B1-S1 voltage too large	- Lambda probe defective (dirty) - Short to positive in signal wire		
16518 B1-S1 no activity	- Lambda probe defective (dirty) - Open circuit in wiring to control unit - No probe heating function - Fuse -S29 defective - Wiring connection for probe heating defective		

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
16705 Engine speed sender Plausibility	- Metal swarf on sensor - Distance between sender and sender wheel greater than 1.3 mm	- Engine misfiring	- Check engine speed sender - => Page 108

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
16706 Engine speed sender No signal	- Open circuit at sender - Open circuit between -J220 and sender - Short to ground or short to screening in signal wire - Open circuit in screening of sender - Sender defective - Signal input in control unit defective (-J220 defective)	- Engine will not start - Engine cuts out	- Rectify short or open circuit according to the current flow diagram - Check engine speed sender - => Page 108

Note:

The plausibility fault is set if the number of signals per crankshaft revolution from the reference gap is incorrect (60 signals).

- Additional signals can be created due to swarf.

- Damaged teeth, an excessive gap between sender and sender wheel or a bent sender wheel can cause signals to be missing or too small, resulting in non-detection.

- The signal sequence can be irregular if the sender wheel is loose.

- Additional signals can be created due to interference signals.

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
16711 Knock sensor 1, signal too small	- Knock sensor loose or corrosion on connector - Open circuit or short between knock sensor and -J220	- High fuel consumption - Loss of power - Restriction of boost pressure (ADR and AEB engines only)	- Read measured value block, Display group 16 =>Page 38 - Tightening torque of knock sensor: 20 Nm - Rectify short or open circuit according to the current flow diagram
16716 Knock sensor 2, signal too small ADR and AEB engines only	- Short circuit between knock sensor and ground or to screening - Knock sensor defective - Signal input in control unit defective (-J220 defective)		

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
16885 Vehicle speed signal Plausibility	- Vehicle speed sender -G68 defective - Short or open circuit between -G68 and speedometer -G21 - Speedometer -G21 defective - Short in signal wire between speedometer and another control unit which is using the vehicle speed signal - Short or open circuit between dash panel insert and Motronic control unit -J220 - Signal input in Motronic control unit defective (-J220 defective)	- No A/C compressor shut-off in first gear under full throttle - Brief deviation between Idling speed and specified speed - Malfunctioning of systems which use the vehicle speed signal	- Check vehicle speed signal => Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations - Read measured value block, Display group 01 - => Page 26 - Check vehicle speed signal



V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
16989 Control unit defective	- Control unit malfunction in overrun at 1320....3000 rpm, - time 2 s	- Loss of power - Restriction of boost pressure (AEB engine only)	- Replace control unit

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
17733 Knock control cyl.1: control limit reached	- Poor quality fuel (less than RON 91) - Intake air temperature sender faulty (AEB engine only) - Abnormal engine running noise (ancillaries loose) - Open circuit in screening of knock sensor 1 or 2 - Loose contact in wiring harness - Loose contact in wiring harness	- High fuel consumption - Loss of power - Irregular engine running - Maximum speed is not reached	- Fill up with petrol of at least 91 RON - Check intake air temperature sender =>Page 115 - Check knock sensors =>Page 37
17734 Knock control cyl.2: control limit reached			
17735 Knock control cyl.3: control limit reached			
17736 Knock control cyl.4: control limit reached			

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
17913 Idling switch not closing/ open circuit	- Throttle valve sticking - Floor mat pressing down on accelerator pedal - Throttle cable setting - Open circuit between idling switch and -J220 - Signal input in control unit defective (-J220 defective) - Idling switch defective	- Idling speed outside specified range - Load change jolt on accelerator release - Air conditioner compressor does not cut in until about 2000 rpm	- Check throttle valve control part => Page 73 - Adjust throttle cable - Rectify open circuit according to the current flow diagram
17914 Idling switch not opening/ short to ground	- Short to ground between idling switch and -J220 - Moisture in throttle valve connector	- Idling speed control switches to open loop control - Idling speed outside specified range - Load change jolt on accelerator release - Air conditioner compressor does not cut in until about 2000 rpm - At coolant temperature below 40 °C overrun shut-off at approx. 1500 rpm before fault is stored	- Check throttle valve control part => Page 73 - Adjust throttle cable - Rectify short circuit according to - current flow diagram

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V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
17978 Engine control unit blocked	- Wiring connection or short circuit to ground or positive between immobiliser control unit and engine control unit	- Engine starts briefly and cuts out again after approx. 1 second	- Test wiring of immobiliser => Current flow diagrams, Electrical fault-finding and fitting locations binder, Immobiliser fault-finding program

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
	- Attempt made to start vehicle with unauthorised key - Engine control unit replaced but not adapted to immobiliser		- Check and if necessary perform key adaptation => Electrical System; Repair Group 96; Servicing immobiliser; Carrying out adaptation of car keys Servicing immobiliser; Carrying out adaptation of car keys - Perform adaptation of engine control unit => Electrical system; Repair Group 96; Servicing immobiliser; Adaptation procedure after renewing engine control unit Servicing immobiliser; Adaptation procedure after renewing engine control unit

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
18010 Voltage supply term. 30, undervoltage detected	- Battery disconnected - Permanent power supply for control unit was disconnected (connector D)	_____	- Check power supply for Motronic control unit =>Page 107
18020 Engine control unit incorrectly encoded	- Control unit detects signals from automatic gearbox even though engine control unit is encoded for manual gearbox	- No noticeable effects	- Encode control unit with correct code

1.8 - Final control diagnosis

Notes:

- ◆ The final control diagnosis can only be performed with the engine stopped and the ignition switched on.
- ◆ The final control diagnosis is terminated if the engine is started or if an engine speed signal is detected.
- ◆ During the final control diagnosis, individual control elements continue to be actuated until the test program is advanced to the next control element by pressing the ⇒key.
- ◆ The control elements can be tested either by listening or by touching.
- ◆ In order to repeat the final control diagnosis without briefly running the engine, briefly switch off the ignition.
- ◆ The electric fuel pump runs throughout the entire final control diagnosis.
- ◆ The final control diagnosis is terminated after 10 minutes.

Actuation sequence of actuators:

Injector, cylinder 1 -N30

Injector, cylinder 2 -N31

Injector, cylinder 3 -N32

Injector, cylinder 4 -N33

Solenoid valve 1 for activated charcoal filter -N80

Boost pressure control solenoid valve -M75 (AEB engine only)

- Connect V.A.G 1551 fault reader =>Page 2 .

-> Display:



Rapid data transfer HELP
Select function XX

Note:

Press **HELP** key to obtain a printout of available functions.

- Press keys 0 and 3
(03 is used to select the function "Final control diagnosis")

-> Display:

Rapid data transfer Q
03 - Final control diagnosis

- Confirm entry with Q key.

-> Display:

Final control diagnosis
Injector, cyl.1 -N30

- Rotate throttle mechanism at throttle valve control part As soon as the idling switch opens, the injector for cylinder 1 clicks five times.
- To switch to the next injector, press the ➡key. (It is also possible to advance the program without checking the injector in question.)
- Use this procedure to check all the injectors in sequence.
- Press ➡key

-> Display:

Final control diagnosis
Solenoid valve 1 for activ: charcoal
filter -N80

This solenoid valve is actuated (clicks) until the final control diagnosis is finished by pressing the ➡key on ADP and ADR engines or, on AEB engines, the final control diagnosis is switched on to the next actuator.

- If the solenoid valve is not actuated (does not click), check -N80 =>Page 78 .
- Press ➡key

AEB engine only

-> Display:

Final control diagnosis Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not
Intake manifold changeover valve -N156 permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability
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This valve is actuated (clicks) until the final control diagnosis is finished by pressing the ➡key.

- If the valve is not actuated (does not click), check -N156.
- Press ➡key

-> Display:

Rapid data transfer HELP
Select function XX

Note:

Briefly switch off the ignition before re-selecting the final control diagnosis with function 03.

1.9 - Reading measured value block

Preconditions:

- ◆ Engine temperature at least 80 °C.
 - ◆ All electrics. loads off.
 - ◆ Air conditioning switched off. Repeatedly press the minus key on the A/C operating and control unit until all of the displays are cleared.
 - ◆ No faults stored in fault memory
- Connect fault reader V.A.G 1551 =>Page 2 .

-> Display:

Rapid data transfer	HELP
Select function XX	

- Press keys 0 and 8
(08 is used to select the function "Read measured value block")

-> Display:

Rapid data transfer	Q
08 - Read measured value block	

- Confirm entry with Q key.

-> Display:

Read measured value block	Q
Enter Display group number XX	

- Select the required display group number according to the display group overview =>Page 20 .

Note:

Display group number 01 is used here as an example to demonstrate the procedure.

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- Press keys 0 and 1
(01 is used to select the function "Display group number 01")

-> Display:

Read measured value block	Q
Enter Display group number	01

- Confirm entry with Q key.

-> Display:

Read measured value block	1
1 2 3 4	

Notes:

- ◆ In display group 00 the measured values are shown in decimal form.
 - ◆ Each time the PRINT key is pressed, the current display readout is printed out.
 - ◆ Press the C key before selecting further display groups.
- If the specified values are achieved in all Display zones, press the =>key.

-> Display:

Rapid data transfer	HELP
Select function XX	

- Press keys 0 and 6



(06 is used to select the function "End output")

-> Display:

Rapid data transfer Q
06 - End output

- Confirm entry with Q key.

-> Display:

Rapid data transfer HELP
Enter address word XX

1.10 - Display group overview

Display group no.	Indicated on display	Designation
00	Read measured value block 0 1 2 3 4 5 6 7 8 9 10	1 = Coolant temperature 2 = Engine load 3 = Engine speed 4 = Battery voltage 5 = Throttle valve angle 6 = Control value, idling air mass 7 = Learned value, idling air mass 8 = Control value for mixture formation (lambda control value) 9 = Learned value for mixture formation (lambda learned value), additive 10 = Learned value for mixture formation (lambda learned value), multiplicative
01 Basic function	Read measured value block 1 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Throttle valve angle 4 = Ignition angle
02 Basic function	Read measured value block 2 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Injection period 4 = Air mass

Display group no.	Indicated on display	Designation
03 Basic function	Read measured value block 3 1 2 3 4	1 = Engine speed 2 = Battery voltage 3 = Coolant temperature 4 = Intake air temperature
04 Idling speed adjustment	Read measured value block 4 1 2 3 4	1 = Throttle valve angle 2 = Idling air mass, learned (no gear engaged on automatic) 3 = Idling air mass, learned, with gear engaged on automatic 4 = Operating status: Idling Part throttle Full throttle Overrun Enrichment

Display group no.	Indicated on display	Designation
05 Idling stabilisation	Read measured value block 5 1 2 3 4	1 = Engine speed (actual) 2 = engine speed (specified) 3 = Idling speed control 4 = Air mass
06 Idling stabilisation	Read measured value block 6 1 2 3 4	1 = Engine speed 2 = Idling speed control 3 = Lambda control 4 = Ignition angle

Display group no.	Indicated on display	Designation
07 Lambda control and ACF system	Read measured value block 7 1 2 3 4	1 = Lambda control 2 = Lambda probe voltage 3 = Duty cycle, solenoid valve 1 for activated charcoal filter -N80 4 = Lambda correction factor with active tank breather
08 Lambda learned values	Read measured value block 8 1 2 3 4	1 = Injection period 2 = Lambda learned value at idling (additive) 3 = Lambda learned value at part throttle (multiplicative) 4 = Tank breather system: TB active (tank breather active) Lambda adaptation (tank breather not active)
09 Lambda learned values	Read measured value block 9 1 2 3 4	1 = Engine speed 2 = Lambda control 3 = Lambda probe voltage 4 = Lambda learned values at idling (additive)
10 Tank breather	Read measured value block 10 1 2 3 4	1 = Duty cycle, solenoid valve 1 for activated charcoal filter -N80 2 = Lambda correction factor with active tank breather 3 = Fill factor of activated charcoal filter -N80 4 = ACF purging quantity
11 Fuel consumption	Read measured value block 11 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Vehicle speed 4 = Fuel consumption

Display group no.	Indicated on display	Designation
12 Fuel consumption during idling	Read measured value block 12 1 2 3 4	1 = Engine speed 2 = Battery voltage 3 = Fuel consumption 4 = Ignition angle
13 Knock- control	Read measured value block 13 1 2 3 4	1 = Ignition timing retardation by knock control, cylinder 1 2 = Ignition timing retardation by knock control, cylinder 2 3 = Ignition timing retardation by knock control, cylinder 3 4 = Ignition timing retardation by knock control, cylinder 4



Display group no.	Indicated on display	Designation
14 Knock-control	Read measured value block 14 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Ignition timing retardation by knock control, cylinder 1 4 = Ignition timing retardation by knock control, cylinder 2
15 Knock-control	Read measured value block 15 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Ignition timing retardation by knock control, cylinder 3 4 = Ignition timing retardation by knock control, cylinder 4
16 Knock-control	Read measured value block 16 1 2 3 4	1 = Knock sensor signal, cylinder 1 2 = Knock sensor signal, cylinder 2 3 = Knock sensor signal, cylinder 3 4 = Knock sensor signal, cylinder 4

Display group no.	Indicated on display	Designation
17 Catalytic converter-warm-up and/or distributor basic setting	Read measured value block 17 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Energy balance for cat warm-up (ADR engine) Position of Hall sender signal (ADP engine) 4 = Ignition angle
18 Altitude compensation	Read measured value block 18 1 2 3 4	1 = Engine speed 2 = Engine load without altitude compensation 3 = Engine load after altitude compensation 4 = Altitude correction factor
19 Torque reduction	Read measured value block 19 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Retardation of ignition angle 4 = Ignition angle
20 Operating states	Read measured value block 20 1 2 3 4	1 = Engine speed 2 = Selector lever position 3 = Air conditioner/rear window 4 = A/C compressor
21 Operating states Lambda control	Read measured value block 21 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Coolant temperature 4 = Lambda control ON/OFF

Display group no.	Indicated on display	Designation
22		For development and production purposes only
23 Adaptation Throttle valve positioner	Read measured value block 23 1 2 3 4	1 = Learning demand display 2 = Min. stop of throttle valve positioner 3 = Emergency running stop of throttle valve positioner 4 = Max. stop of throttle valve positioner
24 Knock control	Read measured value block 24 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Ignition angle 4 = Sum of ignition angle retardation for cylinders 1 to 4

Display group no.	Indicated on display	Designation
25 Boost pressure control	Read measured value block 25 1 2 3 4	1 = Specified load without correction 2 = Specified load after correction 3 = Actual load 4 = Duty cycle, boost pressure control solenoid valve
26 Idling air demand	Read measured value block 26 1 2 3 4	1 = Idling speed control 2 = Idling air mass, learned (no gear engaged on automatic) 3 = Coolant temperature 4 = Engine speed
27 Load reduction through knock control	Read measured value block 27 1 2 3 4	1 = Load reduction through knock control 2 = Engine load after reduction 3 = Engine speed 4 = Duty cycle, boost pressure control solenoid valve

Display group no.	Indicated on display	Designation
28...94		Not used
95...97		For development and production purposes only
98 Adaptation Throttle valve control part	Read measured value block 98 1 2 3 4	1 = Voltage, throttle valve potentiometer 2 = Voltage, idling positioner potentiometer 3 = Operating status: idling/part throttle 4 = Adaptation status Adaptation running, adaptation OK, adaptation ERROR
99 Lambda control	Read measured value block 99 1 2 3 4	1 = Engine speed 2 = Coolant temperature 3 = Lambda control 4 = Lambda control ON

1.11 - Display groups 00 - 07

Display group 00

Display zone	Specified readout	Equivalent measured value	Designation
1	170...204	80...105 °C	Coolant temperature (requirement for basic setting)
2 1)	32...48	1.6...2.4 ms	Engine load (no consumers switched on)
2 2)	20...55	1.0...2.5 ms	
2 3)	10...40	0.5...1.5 ms	
3	76...96	720...960 rpm	Engine speed (no consumers switched on)
4	176...212	12...14.5	Battery voltage
5	0...12	0...5°	Throttle valve angle
6	112...144	-4...+4 kg/h	Idling speed air mass control value (idling speed control)
7	112...144	-4...+4 kg/h	Learned value for idling speed air mass
8 1)	121...137	-5...+5 %	Control value for mixture formation (lambda control value) (only relevant in basic setting and after approx. 1.5 mins)



Display zone	Specified readout	Equivalent measured value	Designation
8 2)3)	115...143	-10...+10 %	

1) Engine code ADP 2) Engine code ADR 3) Engine code AEB

Display zone	Specified readout	Equivalent measured value	Designation
9	243...255 or 0...+13	-0.64... +0.64%	Learned value for mixture formation (lambda learned value) additive (if outside tolerance, perform test drive)
10	118...138	-8...+8 %	Learned value for mixture formation (lambda learned value) multiplicative (if outside tolerance, perform test drive)

1) Engine code ADP 2) Engine code ADR 3) Engine code AEB

Notes on Display zones 9 and 10:

- ♦ In the case of the additive learned value the injection time is changed by a fixed amount which is not dependent on the basic injection time.
- ♦ The multiplicative learned value represents a percentage change in the injection period.

Test table, Display group 00

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
1	higher than 204	- Coolant temperature sender - G62 - Wiring connection to Motronic control unit -J220	- Check G62 =>Page 109
	lower than 170	- Coolant temperature sender - G62 - Wiring connection to Motronic control unit -J220 - Coolant thermostat constantly open	- Check G62 =>Page 109 - Check coolant thermostat
2	Greater than the specified value	- Air conditioner switched on - Electrical consumers on - Lambda control at rich or lean stop - Air conditioner compressor running although air conditioner is off	- Switch off air conditioner - Switch off electrical consumers - Check lambda control - Check A/C compressor actuation
	Less than specified value	- Unmetered air downstream of air mass meter - Unmetered air downstream of throttle valve - Vacuum hose disconnected - Fuel pressure regulator	- Eliminate cause

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
3	lower than 76	- Gear engaged (autom. gearbox) - Engine load from ancillaries - Throttle valve control part -J338 sticking or defective	- Move selector lever to "P" or "N" Eliminate load (air conditioning system/power steering/alternator) Check throttle valve control part - J338

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
	higher than 96	- Idling speed switch -F60 not closed/defective - Large quantity of unmetered air (cannot be compensated by idling stabilisation) - Throttle valve control part -J338 sticking or defective	- Interrogate the fault memory and check/adjust idling switch - Eliminate air leak - Check throttle valve control part - J338
4	lower than 176	- Alternator defective, battery heavily discharged - High load on electrical system shortly after starting engine due to high charge current and load from ancillaries - Contact resistance in the positive supply or ground connection for Motronic control unit - Current drain with ignition off	- Check voltage, charge battery - Increase engine speed for several minutes and switch off ancillaries - Check power supply to Motronic control unit =>Page 107 - Eliminate current drain
	higher than 212	- Voltage control on alternator defective - Excess voltage from assisted start or high speed charger	- Check voltage; if necessary, fit a new voltage regulator. - Interrogate fault memory

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
5	lower than 0	- Not possible	
	higher than 12	- Basic setting of throttle valve control part not performed - Throttle valve potentiometer in throttle valve control part defective - Throttle cable setting not OK - Throttle valve mechanism sticking	- Perform basic setting of throttle valve control part =>Page 73 - Interrogate fault memory =>Page - Adjust throttle cable - => 4-cylinder Engine, Mechanics; Repair Group 20; Removing and installing parts of fuel supply system; Servicing accelerator mechanism - Removing and installing parts of fuel supply system; Servicing accelerator mechanism - Eliminate cause or replace component as required.
6 and 7	lower than 118	- Unmetered air downstream of throttle valve	- Eliminate air leak - Notes on Display group 05, Display zone 3 => Page 31
	higher than 128	- Increased engine load due to ancillaries	- Eliminate load, switch off ancillaries - Notes on Display group 05, Display zone 3 => Page 31

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
8	lower than 121	- Engine running too rich, lambda control in "lean" direction - Large quantity of fuel from ACF system (not with basic setting) - Leak in vacuum hose for fuel pressure regulator - Lambda learned values at stop	- Depress accelerator briefly at 20 sec intervals until learning procedure is finished - => Display group 06, Display zone 3 - Replace vacuum hose - Check lambda learned values, Display group 08 => Page 33
	higher than 137	- Engine running too lean, lambda control enriches mixture - Unmetered air - Injectors defective - Lambda learned values at stop	- Eliminate air leak - Check injection quantity - => Page 33
	Readout fluctuates or remains constant at 128	- Fuel reserve too low - Lambda mixture control is on open loop control	- At least 10 l fuel in tank - Display group 06, note on Display zone 3



Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
9	lower than 243 or higher than 13	- =>Display group 08, Display zones 2 and 3	
10	lower than 118 or higher than 138	- =>Display group 08, Display zones 2 and 3	

Display group 01, basic function

Indicated on display	Specified readout	Designation
Read measured value block 1 1 2 3 4	760...960 rpm	1 = Engine speed (shown in increments of 40 rpm)
	1) 1.6...2.4 ms 2) 1.0...20.5 ms 3) 0.5...1.5 ms	2 = Engine load (injection period per revolution)
	0...5 <o	3 = Throttle valve angle
	12 oBTDC	4 = Ignition angle

1) Engine code ADP 2) Engine code ADR 3) Engine code AEB

Test table, Display group 01

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
1	Less than 760 rpm	- Gear engaged (autom. gearbox) - Engine load from ancillaries - Throttle valve control part -J338 sticking or defective	- Move selector lever to "P" or "N" Eliminate load (air conditioning system/power steering/alternator) Check throttle valve control part - J338
	Greater than 960 rpm	- Idling speed switch -F60 not closed/defective - Large quantity of unmetered air (cannot be compensated by idling stabilisation) - Throttle valve control part -J338 sticking or defective	- Interrogate the fault memory and check/adjust idling switch Eliminate air leak Check throttle valve control part - J338

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
2	Less than specified value	- Technically not possible*	

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
	Greater than specified value	- Poor idling (not running on all cylinders) - Air mass meter - G70 defective - Throttle valve control part -J338 defective - Electrical consumers on - Steering wheel at full lock - Gear engaged (autom. gearbox)	- Injector or spark plugs defective Interrogate fault memory Check throttle valve control part -J338 =>Page 73 Switch off the consumers Centre steering wheel Move selector lever to "P" or "N"

*) Lower values can only occur when vehicle is on overrun.

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
3	Less than 0 <o	- Not possible	
	Greater than 5 <o	- Basic setting of throttle valve control part -J338 not performed - Throttle valve potentiometer in throttle valve control part -J338 defective or incorrectly set - Throttle cable setting - Throttle valve mechanism sticking	- Perform basic setting of throttle valve control part -J338 Interrogate fault memory Check throttle valve control part -J338 =>Page 73 Adjust throttle cable => 4-cylinder Engine, Mechanics; Repair Group 20; Removing and installing parts of fuel supply system; Servicing accelerator mechanism Removing and installing parts of fuel supply system; Servicing accelerator mechanism Rectify fault, replace if necessary
4	Lower than 12oBTDC	- Electrical consumers on - Steering wheel at full lock - Gear engaged (auto. gearbox)	- Switch off the consumers Centre steering wheel Move selector lever to "P" or "N"
	Greater than 12oBTDC	- Not possible	

Notes on Display zone 3:

- ♦ When accelerator pedal is fully depressed, the display value is between approx. 85...90 <o.
- ♦ The following fixed substitute value appears as soon as a fault is detected in the throttle valve potentiometer:

- Engine code ADP: 45 <o

- Engine code ADR: 35 <o

- Engine code AEB: 45 <o

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Display group 02, basic function

Indicated on display	Specified readout	Designation
Read measured value block 2 1 2 3 4	760...960 rpm	Display zone 1 = engine speed (shown in increments of 40 rpm)
	ADP: 1.6...2.4 ms ADR: 1.0...2.5 ms AEB: 0.5...1.5 ms	Display zone 2 = theoretical injection period per crankshaft revolution (engine load)
	ADP: 2.0...3.5 ms ADR: 2.0...5.0 ms AEB: 1.5...3.0 ms	Display zone 3 = corrected injection period per engine cycle
	ADP: 2.5...4.5 g/s ADR: 2.0...4.0 g/s AEB: 1.8...4.0 g/s	Display zone 4 = intake air mass

Test table, Display group 02

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
1		- See Display group 01, Display zone 1	
2		- See Display group 01, Display zone 2	

Note on Display group 2, basic function:

- Display zone 2 shows the injection period which corresponds to the intake air mass and the engine load when idling. This value is a purely calculated, theoretical value which, because of the processor technology, only relates to a single crankshaft revolution. The engine load when idling is the load created by the internal friction which the engine has to overcome and the power required to drive the ancillaries. The intake air mass is shown in Display zone 4.
- Display zone 3, on the other hand, shows the injection period for a complete engine cycle, i.e. two crankshaft revolutions.
- However it is the corrected actual injection period which is shown in Display zone 3 and not the doubled value of Display zone 2. Correction of variables such as:

- *Lambda control*

- *Fuel supply from activated charcoal filter*

- *Air density, air temperature*

- *Vehicle voltage (quicker / slower opening of the injectors)*

- For example, if the engine draws in unmetered air, only the calculated value in Display zone 2 should change (injection period per crankshaft revolution). The lambda control ensures that the actual injection period per engine cycle remains at the specified value.

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
3	Less than specified value	- Large quantity of fuel from the ACF system - Wrong injectors installed (delivery rate too high)	- Check solenoid valve for activated charcoal filter =>Page 59
	Greater than specified value	- Increased engine load due to electric consumers, air conditioner or engaged gear, power-assisted steering at full lock	- Eliminate load
4	Less than specified value	- Large quantity of unmetered air between intake manifold and air mass meter	- Eliminate air leak

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
	Greater than specified value	- Gear engaged (autom. gear-box) - Engine load from ancillaries	- Move selector lever to "P" or "N" - Eliminate load (air conditioning system/power steering/alternator)

Display group 03, basic function

Indicated on display	Specified readout	Designation
Read measured value block 3 1 2 3 4	760...960 rpm	1 = Engine speed (shown in increments of 40 rpm)
	12...140.5 V	2 = Battery voltage
	80...105 °C	3 = Coolant temperature
	...°C	4 = Intake air temperature

Test table, Display group 03

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Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
1		- See Display group 01, Display zone 1	
2	Less than 12 V	- Alternator defective, battery heavily discharged - High load on electrical system shortly after starting engine due to high charge current and load from ancillaries - Contact resistance in the positive supply or ground connection for Motronic control unit - Current drain with ignition off	- Check voltage, charge battery - Increase engine speed for several minutes and switch off ancillaries - Check power supply to Motronic control unit =>Page 107 - Eliminate current drain
	Greater than 14.5 V	- Voltage control on alternator defective - Excess voltage from assisted start or high speed charger	- Check voltage; if necessary, fit a new voltage regulator. - Interrogate fault memory

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
3	Less than 80 °C	- Engine too cold - Sender for coolant temperature or wiring to Motronic control unit	- Test drive if necessary. - Check -G62 =>Page 109
	Greater than 105 °C	- Radiator dirty - Radiator fan not working - Coolant thermostat defective - Sender for coolant temperature or wiring to Motronic control unit	- Clean radiator - Check function - Check coolant thermostat - Check -G62 =>Page 109
41)	Constant 19.5 °C	- Fault detected on intake air temperature sender -G42	- Interrogate fault memory - Page 115



Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
	Greater than 2)	- Intake air temperature sender - G42	- Check -G42 =>Page 115

1) - There is no intake air temperature sender installed for vehicles with engine codes ADP and ADR. A constant value of 19.5 °C is always displayed.

- For vehicles with engine code AEB, the value measured by the intake air temperature sender is displayed.

2) when vehicle is running, up to 24 °C above ambient temperature

when vehicle is stationary, depending on the heat accumulation in the engine and the standing time, up to 110 °C

Note on Display zone 3:

The Motronic control unit operates with voltages of between 10 and 15 V. However, voltages below 12 V or above 14.5 V indicate a defect.

Display group 04, idling speed adjustment

Indicated on display	Specified readout	Designation
Read measured value block 4 1 2 3 4	0...5 <0	1 = Throttle valve angle
	-1.1...5+1.1 g/s	2 = Idling air mass, learned (no gear engaged on automatic)
	-1.7...+1.7 g/s	3 = Idling air mass, learned, with gear engaged on automatic
	Idling	4 = Operating status

Test table, Display group 04

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
1		- See Display Group 01, Display zone 3	
2	Greater than -1.1 g/s	- Unmetered air downstream of throttle valve	- Eliminate air leak
	Greater than +1.1 g/s	- Large load from ancillaries - Constriction/foreign matter in intake area	- Switch off air conditioner and electrical consumers - Eliminate constriction or foreign body

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Note on Display zone 1:

When the accelerator pedal is fully depressed, the display value is between approx. 85...90 <0.

Note on Display zones 2 and 3:

The display shows how far the learned values of the idle stabilisation have "drifted away" from the pre-programmed mean value. With a new engine, the display will show a positive value because of the greater friction; if the engine has been run in it will show a negative value. A value of - 1.1 g/s combined with an excessively low value in Display group 05, Display zone 3, indicates the presence of unmetered air.

- ♦ The value displayed is not measured by the air mass meter but calculated from information from the throttle valve potentiometer.
- ♦ On vehicles with a manual gearbox Display zone 3 always displays 0.

Note on Display zone 4:

The following operating statuses are displayed:

- ◆ Idling
- ◆ Part throttle
- ◆ Full throttle
- ◆ Overrun
- ◆ Enrichment (full throttle enrichment)

Display group 05, idling stabilisation

Indicated on display	Specified readout	Designation
Read measured value block 5 1 2 3 4	820...900 rpm	1 = Engine speed (actual)
	860 rpm	2 = Engine speed (specified)
	-10...+10 %	3 = Idling speed control
	1) 2.5...4.5 g/s 2) 2.0...4.0 g/s 3) 1.8...4.0 g/s	4 = Air mass

1) Engine code ADP 2) Engine code ADR 3) Engine code AEB

Note on Display zone 1:

- ◆ The actual engine speed is displayed in increments of 10 (max. 2550 rpm).
- ◆ Fault cause and fault remedy =>Display group 2, Display zone 1.

Note on Display zone 2:

The specified engine speed set by the Motronic control unit is displayed.

Note on Display zone 3:

During idling, the air mass requirement varies with changing load conditions, even though the engine speed is constant. The change in air mass during idling is shown as a percentage. As soon as the change has been compensated by the idle stabilisation learning process, the mean value is restored. The amount of deviation from the mean value depends on the extent of the load change (e.g. as a result of switching electrical consumers on or off). The learning process proceeds in small stages each time the idling switch closes. In the event of a large deviation, several stages are required. To do this, depress the accelerator pedal briefly in 20 second intervals (brief burst of throttle). Every burst of throttle moves the learning process along a further step.

The deviation that has "drifted away" then appears in Display group 04, Display zone 2. The idling speed control values remain outside tolerance if the learned values in Display group 04, Display zone 2 have run on to the stop.

Stop values:

Engine code ADP: -1.13 or +1.42 g/s

Engine code ADR: -1.70 or +1.70 g/s

Engine code AEB: -1.13 or +1.13 g/s

Note on Display zone 4:

- ◆ The display shows the air mass measured by the air mass meter.

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- ♦ If the vehicle is in emergency running mode due to a fault in the throttle valve control part, then the engine runs without idling stabilisation with an increased idling speed (approx. 110...1300 rpm) caused by the emergency running gap. The air throughput is roughly 4.5...5.5 g/s.

Display group 06, idling stabilisation

Indicated on display	Specified readout	Designation
Read measured value block 6 1 2 3 4	820...900 rpm	1 = Engine speed (display in increments of 10; max. 2550 rpm)
	-10...+10 %	2 = Idling speed control
	1) -5...+5 % 2) -10...+10 % 3) -10...+10 %	3 = Lambda control
	12 °BTDC	4 = Ignition angle

1) Engine code ADP 2) Engine code ADR 3) Engine code AEB

Test table, Display group 06

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
1		- See Display group 01, Display zone 1	
2		- See Display group 05, Display zone 3	

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Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
3	Outside tolerance range	Negative display - engine too rich, consequence: Lambda control produces leaner mixture Positive display ("+" is not displayed) - engine too lean, consequence: Lambda control produces richer mixture - Unmetered air - Injector defective - Lambda learned values (Display group 00 or 08) at stop	- Wait 30 seconds until the display has stabilised - Eliminate air leak - Check injection quantity =>Page 33
4		- See Display group 01, Display zone 4	

Note on Display zone 3:

The display should fluctuate around 0. If a constant value of 0 is displayed then the lambda control has switched from closed loop to open loop control because a fault is present in the lambda control =>Interrogate fault memory or check Display group 21, Display zone 4.

Display group 07, lambda control and ACF system

Indicated on display	Specified readout	Designation
Read measured value block 7 1 2 3 4	1) -5...+5 % 2) -10...+10 % 3) -10...+10 %	1 = Lambda control
	-0.1 ... +1.1 V	2 = Lambda probe voltage
	0...99	3 = Duty cycle, solenoid valve 1 for activated charcoal filter

Indicated on display	Specified readout	Designation
	0.3...1.2	4 = Lambda correction factor with active tank breather

1) Engine code ADP 2) Engine code ADR 3) Engine code AEB

Note on Display zone 1:

=>Display group 06, Display zone 3

Note on Display zone 2:

The voltage signal for "Mixture rich" (low level of residual oxygen) is between about 0.7 and 1.1 V (referenced to reference ground).

The voltage signal for "Mixture lean" (high residual oxygen) is between about -0.1..+0.3 V (referenced to reference earth).

During the transition from "rich" to "lean" and vice versa ($\lambda = 1.0$), there is a voltage jump from 0.7...1.1 V to -0.1...0.3 V or vice versa.

Because of the sharp voltage jump the lambda control cannot maintain a constant ideal mixture composition of $\lambda = 1.0$. The system fluctuates continuously between "slightly too lean" and "slightly too rich".

Note on Display zone 3:

A duty cycle of 0 means that ACF solenoid valve 1 is closed. At a duty cycle of 99 the solenoid valve is fully open.

Note on Display zone 4:

- ♦ At a display value of 0.3 the engine is receiving a very rich mixture from the ACF system. - The lambda control therefore has to reduce the injection quantity to 30%.
- ♦ At a display value of 1.0 the ACF system is either delivering an ideal mixture (no intervention towards lean or rich required), or the ACF valve is closed (adaptation =>Display group 08, Display zone 4).
- ♦ If the value displayed is 1.01 ... 1.2 then the mixture coming from the ACF system is too lean. - The lambda control therefore has to enrich the mixture.

1.12 - Display groups 08 - 98

Display group 08, lambda learned values

Indicated on display	Display range	Designation
Read measured value block 8 1 2 3 4	1) 2.0...3.5 ms	1 = Injection period
	2) 2.0...5.0 ms	
	3) 1.5...3.0 ms	
	1) -10...+10 %	2 = Lambda learned value at idling (additive)
	2) -10...+10 %	
	3) -12...+12 %	
	1) -8...+8 %	3 = Lambda learned value at part throttle (multiplicative)
	2) -8...+8 %	
	3) -12...+12 %	



Indicated on display	Display range	Designation
	TB active or λ-adaptation	4 = "TB active" means that ACF solenoid valve 1 is cycled (6 min) "λ-adaptation" means that ACF solenoid valve 1 is constantly closed (1 min)

1) Engine code ADP 2) Engine code ADR 3) Engine code AEB

Test table, Display group 08

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
1		- See Display group 02, Display zone 3	
3 and 4	Low lambda learned values	- Lambda learned values low for idling and normal for part throttle: Oil dilution possible (high amount of fuel in the oil) - Injector leaking - Fuel pressure too high - Solenoid valve 1 for activated charcoal filter -N80 is constantly open - Air mass meter -G70 defective - Lambda probe heating defective or lambda probe dirty	- Disappears after a drive on the motorway or after an oil change - Check injectors => Page 32

Note on Display zones 2 and 3:

Low values mean that the engine is running too rich, and the lambda control is compensating by leaning out the mixture.

3 and 4	High lambda learned values	- Lambda learned values high for idling and less high for part throttle: unmetered air possible around intake manifold - Injector clogged - Display zones 2 and 3 high: Air mass meter -G70 defective - Fuel pressure too low (fuel supply) - Unmetered air between -G70 and throttle valve - Unmetered air at manifold gasket - Lambda probe heating defective or lambda probe dirty	- Eliminate cause - Check injection quantity => Page 57 - Eliminate cause - Check lambda probe heating =>Page 32
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Note on Display zones 2 and 3:

- ♦ High learned values mean that the engine is running too lean, and therefore the lambda control is compensating by enriching the mixture.
- ♦ If there is no voltage in the control unit, all the learned values will be reset.
- ♦ 'Additive' means that the impact of the fault decreases as the engine speed increases (e.g. unmetered air).
- ♦ 'Multiplicative' means that the impact of the fault increases as the engine speed increases (e.g. injector fault).

Note on Display zone 4:

During the λ-adaptation the lambda control "learns" the operating conditions without the deviation due to the fuel vapours from the activated charcoal filter (ACF valve closed).

Display group 09, lambda learned values

Indicated on display	Specified readout	Designation
Read measured value block 9 1 2 3 4	820...900 rpm	1 = Engine speed (display in increments of 10; max. 2550 rpm)
	1) -5...+5 % 2) -10...+10 % 3) -10...+10 %	2 = Lambda control
	-0.1 ... +1.1 V	3 = Lambda probe voltage
	1) -10...+10 % 2) -10...+10 % 3) -12...+12 %	4 = Lambda learned value at idling (additive)

1) Engine code ADP 2) Engine code ADR 3) Engine code AEB

Note on Display zone 1:

=>Display group 01, Display zone 1

Note on Display zone 2:

=>Display group 06, Display zone 3

Note on Display zone 3:

=>Display group 07, Display zone 2

Note on Display zone 4:

=>Display group 08, Display zone 2

Display group 10, tank breather

Indicated on display	Display range	Designation
Read measured value block 10 1 2 3 4	0...99 %	1 = Duty cycle, solenoid valve 1 for activated charcoal filter
	0.3...1.2	2 = Lambda correction factor with active tank breather
	-3...+30	3 = Fill factor of activated charcoal filter
	0.00...0.30	4 = ACF purging quantity

Note on Display zone 1:

=>Display group 07, Display zone 3

Note on Display zone 2:

=>Display group 07, Display zone 4

Note on Display zone 3:

At a value of -3 there are no fuel vapours in the ACF canister.

At a value of +30 the ACF canister is completely full of fuel vapours.

**Note on Display zone 4:**

The display shows the percentage by volume of the activated charcoal filter system referenced to the total intake volume.

At a value of 0.00 nothing is delivered by the ACF system (solenoid valve closed).

At a value of 0.30, 30 % of the intake air mass comes from the ACF system.

Display group 11, fuel consumption:

This display group can be used to assess the dependency of fuel consumption on engine speed, engine load and vehicle speed.

Indicated on display	Specified readout	Designation
Read measured value block 11 1 2 3 4	rpm	1 = Engine speed (shown in increments of 40 rpm)
	1) 1.6...2.4 ms 2) 1.0...2.5 ms 3) 1.0...2.5 ms	2 = Engine load (injection period per revolution)
	0 km/h	3 = Vehicle speed
	1) 0.5...1.1 l/h 2) 0.5...1.5 l/h 3) 0.5...1.5 l/h	4 = Fuel consumption

1) Engine code ADP 2) Engine code ADR 3) Engine code AEB

Notes on Display zone 2:

- ♦ The maximum engine load decreases by about 10 % for every 1000 m above sea level.
- ♦ The maximum engine load also falls by up to 10 % at very high ambient temperatures.

Note on Display zone 4:

The specified readout value only applies to idling without any ancillary loads (autom. gearbox, air conditioner/heater, alternator, power steering pump)

The values when driving at full throttle should not be less than the following:

at 4000 rpm at 6000 rpm

- ♦ Engine code ADP: 7.0 ms 6.1 ms
ADR: 7.5 ms 6.5 ms
AEB: 6.5 ms 6.0 ms

Display group 12, fuel consumption during idling

Indicated on display	Specified readout	Designation
Read measured value block 12	820...900 rpm	1 = Engine speed (display in increments of 10; max. 2550 rpm)
1 2 3 4	12...14.5 V:	2 = Battery voltage
	1) 0.5...1.1 l/h 2) 0.5...1.5 l/h 3) 0.5...1.5 l/h	3 = Fuel consumption

Indicated on display	Specified readout	Designation
	12 oBTDC	4 = Ignition angle

1) Engine code ADP 2) Engine code ADR 3) Engine code AEB

Note on Display zone 1:

=> Display group 01, Display zone 1

Note on Display zone 2:

=> Display group 03, Display zone 2

Note on Display zone 3:

=> Display group 11, Display zone 4

Note on Display zone 4:

=> Display group 01, Display zone 4

Display group 13, knock control

Indicated on display	Specified readout	Designation
Read measured value block 13 1 2 3 4	0...15 oCS	1 = Ignition timing retardation by knock control, cylinder 1
	0...15 oCS	2 = Ignition timing retardation by knock control, cylinder 2
	0...15 oCS	3 = Ignition timing retardation by knock control, cylinder 3
	0...15 oCS	4 = Ignition timing retardation by knock control, cylinder 4

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Notes:

- ◆ Knock control is active over the entire engine speed range from a 3 ms engine load upwards. When a 3 ms engine load is exceeded the current values for the ignition timing retardation are displayed. If the load is below this value then the ignition timing retardation is cancelled again.
- ◆ If there is audible knocking but no retardation of the ignition timing then increase the engine speed to above 3000 rpm for 5 seconds to initiate the knock sensor fault detection (diagnosis).
- ◆ If the ignition timing retardation value differs greatly from one cylinder to the others then the following faults are possible:
 - Loose ancillaries
 - Corrosion on the plug connector
 - Engine damage (e.g. oil combustion due to a defective piston)
- ◆ If the ignition timing retardation values for all the cylinders are high, the following faults are possible:
 - Corrosion at connector
 - Specified torque (20 Nm) not achieved
 - Open circuit
 - Knock sensor defective
 - Loose ancillaries
 - Poor fuel quality

Display group 14, knock control

Indicated on display	Specified readout	Designation
Read measured value block 14 1 2 3 4	... rpm	1 = Engine speed (shown in increments of 40 rpm)
	... ms	2 = Engine load (injection period per revolution)
	0...15 oCS	3 = Ignition timing retardation by knock control, cylinder 1



Indicated on display	Specified readout	Designation
	0...15 oCS	4 = Ignition timing retardation by knock control, cylinder 2

Notes:

- ♦ With this display group it is possible to check the ignition timing retardation for cylinders 1 and 2 at specific engine speeds and under specific load conditions.
- ♦ Causes for ignition timing retardation =>Display group 13

Display group 15, knock control

Indicated on display	Specified readout	Designation
Read measured value block 15 1 2 3 4	... rpm	1 = Engine speed (shown in increments of 40 rpm)
	... ms	2 = Engine load (injection period per revolution)
	0...15 oCS	3 = Ignition timing retardation by knock control, cylinder 3
	0...15 oCS	4 = Ignition timing retardation by knock control, cylinder 4

Notes:

- ♦ With this display group it is possible to check the ignition timing retardation for cylinders 3 and 4 at specific engine speeds and under specific load conditions
- ♦ Causes for ignition timing retardation =>Display group 13

Display group 16, knock control

Indicated on display	Specified readout	Designation
Read measured value block 16 1 2 3 4	0.6...1.4 V	1 = Knock sensor signal, cylinder 1
	0.6...1.4 V	2 = Knock sensor signal, cylinder 2
	0.6...1.4 V	3 = Knock sensor signal, cylinder 3
	0.6...1.4 V	4 = Knock sensor signal, cylinder 4

Notes:

- ♦ If the difference between the highest and lowest knock control signals is more than 50%, this may be due to corrosion on the connector.
- ♦ If no faults are detected during the electrical testing of the knock sensor, the wiring and the plug connection, then the engine should be checked for loose ancillaries or engine damage =>Display group 13.
- ♦ At higher engine speeds, the voltage signal displayed for the knock sensors may reach values of up to 5.1 V.

Display group 17, distributor basic setting (engine code ADP only)

Indicated on display	Specified readout	Designation
Read measured value block 17 1 2 3 4	820...900 rpm	1 = Engine speed (shown in increments of 40 rpm)
	10...25 ms	2 = Engine load (injection period per revolution)
	-12...+12 oCS	3 = Position of Hall sender signal
	12 oCS	4 = Ignition angle

Notes:

The position of the Hall sender is set by rotating the distributor. The Motronic control unit can process the signal in a range from -12...+12 oCS.

Keep to a range of -3...+3 oCS when adjusting.

Display group 17, CAT heating (engine code ADR1) only)

Indicated on display	Specified readout	Designation
Read measured value block 17 1 2 3 4	...rpm	1 = Engine speed (shown in increments of 40 rpm)
	... ms	2 = Engine load (injection period per revolution)
	0.00...2.00	3 = Energy balance for cat heating
	 oBTDC	4 = Ignition angle

1)With engine code AEB this display group is irrelevant, as the catalytic converter is located so close to the engine.

Notes:

- ♦ In order to bring the catalytic converter up to operating temperature as quickly as possible after a cold start, the engine speed is raised to approx. 1200 rpm during idling and the ignition timing is retarded up to a maximum of 6 oATDC. In the part throttle range only the retardation of the ignition angle is effective.
- ♦ This function for rapid heating of the catalytic converter is effective at starting temperatures of -10 to +39 oC.
The function is aborted under the following conditions:
 - Engine speed greater than 4000 rpm
 - Load above 7.4 ms
 - Energy balance above 1.0
 - Full throttle for longer than 2 sec.
 - Vehicle speed greater than 55 km/h
 - A/C on
 As soon as the function has been aborted the display for the energy balance stops and is reset during the next start.
- ♦ The function does not become effective again if the values are below the above criteria.
- ♦ As soon as the energy balance counter reaches the value 1 the catalytic converter is at operating temperature (at least 120 ml of fuel have been burned). The counter keeps going up to a value of 2. This display has no relevance.

Display group 18, altitude compensation

Indicated on display	Specified readout	Designation
Read measured value block 18 1 2 3 4	... rpm	1 = Engine speed (shown in increments of 40 rpm)
	... ms	2 = Engine load without altitude compensation (injection period per revolution)
	...ms	3 = Engine load after altitude compensation
	-30...+25%	4 = Altitude correction factor

Notes:

The Motronic control unit compares the load signal from the air mass meter with a load value calculated from the throttle valve angle and the engine speed. The difference between the two values is the altitude correction factor. On AEB engines the altitude compensation is carried out via the altitude sensor. Display zone 4 therefore always shows 0 %.

The following factors are influenced by the altitude compensation:

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- ♦ Determination of starting fuel delivery
- ♦ Acceleration enrichment
- ♦ Lean mixture during deceleration
- ♦ Intake manifold pulsation compensation

No altitude compensation is necessary at altitudes of approx. 400 m above sea level under standard weather conditions.

- at sea level the correction factor is up to + 5 %.

- at an altitude of 2000 m the correction factor is approx. +20 %.

- the correction factor can vary significantly depending on the weather conditions.

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Display group 19, torque reduction (vehicles with automatic gearbox only)

Indicated on display	Display range	Designation
Read measured value block 19 1 2 3 4	...rpm	1 = Engine speed (shown in increments of 40 rpm)
	... ms	2 = Engine load
	... oCS	3 = Retardation of ignition angle
	... oCS	4 = Ignition angle

Notes:

- ♦ This display group can be used to assess how the ignition timing retardation reduces the engine torque on changing gear and thus makes gear shifts smoother.
- ♦ Because of the brief signal, the V.A.G 1551 does not always recognise the ignition timing retardation.

Display group 20, operating states

Indicated on display	Display	Designation
Read measured value block 20 1 2 3 4	... rpm	1 = Engine speed (display in increments of 10; max. 2550 rpm)
	Neutral Gear ENG.	2 = Selector lever position: neutral or gear engaged
	A/C high A/C low	3 = Air conditioner High = high heating or cooling output Low = low heating or cooling output
	Compr. OFF Compr. ENG.	4 = A/C compressor OFF/ON

Note on Display zone 2:

On vehicles with a manual gearbox the display always reads "Gear ENG".

Note on Display zone 3:

On vehicles without air conditioner the display shows "A/C high" when the rear window heating is switched on.

Note on Display zone 4:

Vehicles without air conditioner always show "Compr. OFF".

Display group 21, operating status of lambda control

Indicated on display	Display range	Designation
Read measured value block 21 1 2 3 4	... rpm	1 = Engine speed (shown in increments of 40 rpm)
	... ms	2 = Engine load
	... oC	3 = Coolant temperature
	λ- control OFF λ- control ON	4 = Lambda control ON/OFF

Notes:

At starting temperatures below +5 oC the lambda control is not released by the Motronic control unit until a coolant temperature of +5 oC is reached.

At starting temperatures above +5 oC the lambda control does not start until a signal voltage is detected.

When the lambda control is switched off, the engine runs according to the map stored in the control unit.

Display group 22

This Display group is only intended for development and production.

The values shown have no relevance for fault finding in the workshop.

Display group 23, adaptation of throttle valve control part

Indicated on display	Specified readout	Designation
Read measured value block 23 1 2 3 4	1 0 0 0 0 0	0 = Throttle valve potentiometer adjustment with Potentiometer for idling adjuster not OK
		. 1 = No relevance or not possible
		. . 1 . . . = Learning process max stop of throttle valve potentiometer not OK.
		. . . 1 . . = Learning process min. stop of throttle valve potentiometer not OK.
		 1 . = Learning process max. stop of potentiometer for idling adjuster not OK
		 = Learning process min. stop of potentiometer for idling adjuster not OK
	70...93 %	Display zone 2 = min. stop of throttle valve positioner
	67...83 %	Display zone 3 = emergency running stop of throttle valve positioner
	08...39 %	Display zone 4 = max. stop of throttle valve positioner

Note:

6 digits appear in Display zone 1

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**Note on Display zone 1:**

If the specified readout value is not achieved: Perform basic setting of throttle valve control part =>Page 74

Note on Display zones 2, 3 and 4:

Display shows stop values learnt during last basic setting..

Note on Display zones 1, 2, 3 and 4:

If specified display value is still not attained after performing basic setting, check wiring for open circuit/short circuit and connectors for dirt/corrosion before renewing throttle valve control part.

Display group 24, knock control

Indicated on display	Specified readout	Designation
Read measured value block 24 1 2 3 4	... rpm	1 = Engine speed (shown in increments of 40 rpm)
	... ms	2 = Engine load
	... oBTDC	3 = Ignition angle
	... oCS	4 = Sum of ignition angle retardation for cylinders 1 to 4

Notes:

The knock control must retard the ignition timing as soon as knocking is detected in order to prevent damage to the engine.

However, the ignition timing retardation increases the exhaust gas temperature. There is a risk of overheating for the catalytic converter and on the AEB engine, also for the turbocharger.

An ignition timing retardation of for example 3 oCS on all cylinders has exactly the same effect as an ignition timing retardation of 12oCS on a single cylinder.

To avoid overheating, a richer mixture is supplied when the total ignition timing retardation exceeds approx. 10 oCS at full throttle

From a total ignition timing retardation of approx. 24 oCS the boost pressure is also reduced on the AEB engine.

Display group 25, boost pressure control (engine code AEB only)

Indicated on display	Specified readout	Designation
Read measured value block 25 1 2 3 4	3.0...8.0 ms	1 = Specified load without correction
	3.0...8.0 ms	2 = Specified load after correction
	0.5...8.0 ms	3 = Actual load
	0...99 %	4 = Duty cycle, boost pressure control solenoid valve

Notes:

- ♦ This display group should only be assessed at full throttle.
- ♦ The driver sets the specified load through the position of the accelerator pedal (display zone 1).
The specified load is reduced by the following correction factors:
 - Total ignition timing retardation through knock control above 24 oCS
 - Altitude compensation (map-dependent)
 - Coolant temperature above 105oC
 The boost pressure control limits the load to the specified load after correction.
- ♦ If the actual load deviates from the specified load by more than 0.5 ms (Display zone 2 or 3) then there is a fault in the boost pressure control.

- ♦ As soon as the Motronic control unit detects a difference of more than 1 ms, a fault is stored in the boost pressure control and the boost control solenoid valve is actuated with a fixed duty cycle of 5 %.

Display group 26, idling air demand (engine code AEB only)

Indicated on display	Specified readout	Designation
Read measured value block 26 1 2 3 4	-10%...+10 %	1 = Idling speed control
	-1.1...+1.1 g/s	2 = Idling air mass, learned (no gear engaged on automatic)
	80...105 °C	3 = Coolant temperature
	760...960 rpm	4 = Engine speed (shown in increments of 40 rpm)

Note on Display zone 1:

=>Display group 05, Display zone 3

Note on Display zone 2:

=>Display group 04, Display zone 2

Note on Display zone 3:

=>Display group 03, Display zone 3

Note on Display zone 4:

=>Display group 01, Display zone 1

Display group 27, load reduction through knock control (engine code AEB only)

Indicated on display	Specified readout	Designation
Read measured value block 27 1 2 3 4	0...5ms	1 = Load reduction through knock control
	0.5...0.8 ms	2 = Engine load after reduction
	... rpm	3 = Engine speed (shown in increments of 40 rpm)
	0...99 %	4 = Duty cycle, boost pressure control solenoid valve

Notes:

The boost pressure is reduced in order to limit the engine load.

The load is determined from the air mass meter signal.

If the sum of engine load plus load reduction reaches or exceeds a value of 8, this indicates a fault in the area of the air mass meter.

Display group 98, throttle valve control part

Indicated on display	Specified readout	Designation
Read measured value block 98 1 2 3 4	...V	1 = Voltage, throttle valve potentiometer
	... V	2 = Voltage, idling positioner potentiometer
	Idling Part throttle	3 = Operating status



Indicated on display	Specified readout	Designation
	ADP running ADP OK ADP ERROR	4 = Adaptation status

Note on Display zone 4:

ADP = Adaptation =>check throttle valve control part=>Page 73.

1.13 - Perform basic setting of engine

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Notes:

- ♦ All learned values in the control unit are deleted when the connector on the Motronic control unit is disconnected or when the battery is disconnected. This may be followed by rough idling for a brief period. In this case, leave the engine idling for several minutes until learning process has been completed.
- ♦ Learning is prohibited as soon as a fault affecting the lambda control has been stored in the fault memory (does not apply to sporadic faults).
- ♦ The basic setting is performed with the engine running.
- ♦ The specified values and display ranges are identical with the function 08, Read measured value block.
- ♦ The basic setting of the throttle valve control part (via Display group 98) is described in Repair Group 24 under "Checking throttle valve control part".
- ♦ Display group 99 is used to switch off the lambda control in the Basic setting function. This makes it possible to check whether any change occurs by switching the lambda control off or on when dealing with handling problems. It is possible to switch back and forward in the selected display group between the functions "Read measured value block" and "Basic setting" using the keys 4 and 8.
- ♦ After function 04 has been selected the Motronic control unit carries out the following operations:
 - ACF valve is closed.
 - Air-conditioner compressor is deactivated

Preconditions:

- ♦ Engine temperature at least 80 °C.
- ♦ Accelerator not depressed.
- ♦ All electrical loads off.
- ♦ Air conditioning switched off.
- ♦ Vehicles with automatic gearbox: Selector lever set to P or N.
- ♦ No faults stored in fault memory
- Interrogate and erase fault memory - Page 4 . No faults must be stored (if necessary, rectify fault, delete fault memory, switch off and re-start engine, perform test drive and interrogate the fault memory again as a check).
- Leave engine idling.

-> Display:

Rapid data transfer	HELP
Select function XX	

Note:

Press HELP key to obtain a printout of available functions.

- Press keys 0 and 4
(04 is used to select the function "Basic Setting")

-> Display:

Rapid data transfer	Q
04 - Start basic setting	

- Confirm entry with Q key.

-> Display:

Start basic setting Q
Enter Display group number XX

- Select the required display group number from the display group overview in the "Read measured value block" section.

Note:

Display group number 01 is used here as an example to demonstrate the procedure.

- Press keys 0 and 1
(01 is used to select the function "Display group number 01")

-> Display:

Start basic setting Q
Enter display group number 01

- Confirm entry with Q key.

-> Display:

Basic setting 1
1 2 3 4

Notes:

- ◆ In display group 00 the measured values are shown in decimal form.
- ◆ Each time the PRINT key is pressed, the current display readout is printed out.
- ◆ Press the C key before selecting further display groups.

- If the specified values are achieved in all display zones, press the =>key.

-> Display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 6
(06 is used to select the function "End output")

-> Display:

Rapid data transfer Q
06 - End output

- Confirm entry with Q key.

-> Display:

Rapid data transfer HELP
Enter address word XX

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1.14 - Replacing Motronic control unit

Notes:

- ◆ When the connectors are unplugged, the learned values are deleted, although the contents of the fault memory are retained.
- ◆ After installing a new control unit, it is essential to carry out the following steps:
 - Adaptation to the electronic immobiliser
 - Coding of the Motronic control unit (the control unit is supplied from the factory with the code 04001).
 - Basic setting of throttle valve control part -J338
 - Basic setting of the engine



- ♦ In the first learning phase, during the basic setting operation for the engine, slightly irregular idling and slight jolting during driving are possible.

Check the control unit identification and code before removing the Motronic control unit.

- Connect fault reader V.A.G 1551 and check the control unit identification.

-> The control unit identification and the coding appear in the display.

8D0907557C	1.8L	R4/5V MOTR. HS
D. . □		
Code 04001	WSC00000	

- Print out the control unit identification and compare the coding to the coding variants.
- Press the ➡ key.
- Switch off the ignition and after waiting at least 10 seconds disconnect the plug connections of the Motronic control unit.

Fitting location of the Motronic control unit => Page 52 .

- Fit the new Motronic control unit and carry out the following steps.
 - Adapt the Motronic control unit to the immobiliser control unit.

=> Electrical system, Adaptation when changing the engine control unit

- Code the new Motronic control unit
=>Page 46 .
- Carry out basic setting of the throttle valve control part -J338 => Page 74 .
- Carry out basic setting of the engine => Page 44 .

1.15 - Coding the Motronic control unit

Notes:

- ♦ Following introduction of the automatic version in the A4 it is now necessary to encode the engine control units for engine code ADR (1.8 l).
 - ♦ The engine control units for engine codes ADP (1.6 l) and AEB (1.8 l turbo) cannot be encoded.
 - ♦ Encoding is carried out using fault reader V.A.G 1551 or 1552.
 - ♦ During control unit identification a 5-digit code must always be displayed.
 - ♦ Incorrect coding can lead to increased exhaust emission values.
- Connect fault reader V.A.G 1551
=>Page 2 .

-> Display:

Rapid data transfer	HELP
Select function XX	

- Press keys 0 and 7

(07 is used to select the function "Code control unit")

-> Display:

Rapid data transfer	Q
07 - Coding control unit	

- Confirm entry with Q key.

-> Display:

Code control unit	Q
Enter code number XXXXX	(0-32000)

- Enter the appropriate code number for this vehicle and confirm with Q key.

Coding variants=>Page 47

-> If this display appears:

Function unknown or cannot
be carried out at the moment

An unknown or non-approved code number has been entered, or no operating number has been entered in the fault reader.

-> The control unit identification and the entered code appear in the display.

8D0907557C 1.8l R5/5V Motr. HS
D...
Code 04001 WSC00000

- Press the => key.

-> Display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 6

(06 is used to select the function "End output".)

-> Display:

Rapid data transfer Q
06 - End output

- Confirm entry with Q key.

1.16 - Coding variants for the engine control unit

Country/emissions	Drive/auxiliary functions	Gearbox	Model
00 = -----	0 = FWD	0 = 5-speed manual gearbox	0 = -----
01 = -----	1 = -----	1 = -----	1 = A4
Non-member states of the European Union (MVEG I)	2 = 4WD	2 = -----	2 = -----
03 = -----	3 = -----	3 = Automatic gearbox	3 = -----
Member states of the European Union (MVEG II)	4 = -----	4 = -----	4 = -----
05 = -----	5 = -----	5 = -----	5 = -----
06 = -----	6 = -----	6 = -----	6 = -----
07 = -----	7 = -----	7 = -----	7 = -----
08 = China and Confederation of Independent States (CIS)	8 = -----	8 = -----	8 = -----
25 = Japan	9 = -----	9 = -----	9 = -----

The example below is presented to show how the code number is made up:

Audi A4:
Automatic gearbox
FWD

1

3

0



Member states of the European Union	04	
Code No.:	04	0 3 1

1.17 - Connecting test box V.A.G 1598

Notes:

- ♦ The test box must not be connected when performing diagnosis with fault reader V.A.G 1551.
- ♦ The connectors of the Motronic control unit must not be disconnected until 30 seconds after switching off the ignition.

Procedure:

- Switch off the ignition.
- Remove the Motronic control unit
- Connect adapter cable V.A.G 1598/19 between the Motronic control unit and the engine wiring harness

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24 - Mixture preparation, Injection

1 - Servicing Motronic fuel injection system

1.1 - Servicing Motronic fuel injection system

1.2 - Safety precautions

To prevent injuries to persons and/or damage to the ignition system and fuel injection system, the following must be noted:

- ◆ Always switch off the ignition before connecting or disconnecting ignition system wiring or tester cables.
- ◆ To operate the engine at starting speed without actually starting it (for example, to check the compression), unplug the connector from the power output stage for the ignition coils and the connectors from the injectors.
- ◆ For assisted starts with a rapid charging unit the maximum permissible voltage is 16.5 V and the maximum charging time is 1 minute.
- ◆ Always switch off the ignition before washing the engine.
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the Motronic control unit may be damaged.
- ◆ Vehicles that have an actual or suspected fault in the ignition system must not be towed unless the connector at the power output stage is unplugged.
- ◆ Always use the adapter wiring set V.A.G 1594 for connecting test equipment.

1.3 - Rules for cleanliness

Pay careful attention to the following "5 rules" for cleanliness when carrying out work on the fuel supply/fuel injection system:

- ◆ Thoroughly clean all unions and the adjacent areas before disconnecting.
- ◆ Place removed parts on a clean surface and cover. Use sheeting and paper. Do not use fibrous cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean parts.
 - Do not remove replacement parts from their wrapping until you are ready to install them.
 - Do not use parts that have been stored without their packaging (e.g. in tool boxes etc.).
- ◆ When the system is open:
 - Do not work with compressed air if this can be avoided.
 - Do not move vehicle unless absolutely necessary.

1.4 - Technical data

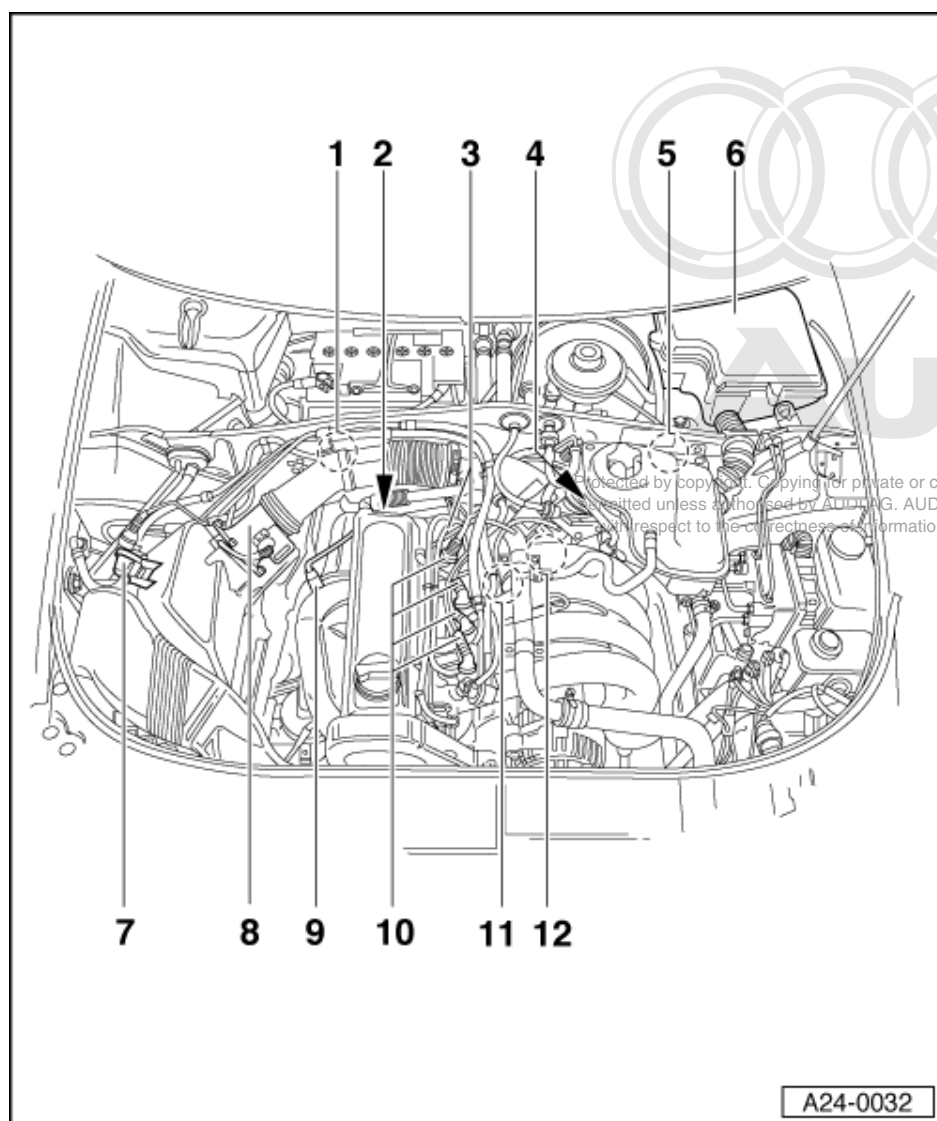
Engine code letters		ADP	ADR	AEB
Idling speed -Idling speed is not adjustable, and is controlled by the idling speed stabilisation		820...900 rpm	820...900 rpm	820...900 rpm
Engine speed limitation -by deactivation of injectors		6500 rpm	6800 rpm	6800 rpm
Fuel pressure -at idling speed	vacuum hose connected	approx. 3.5 bar		



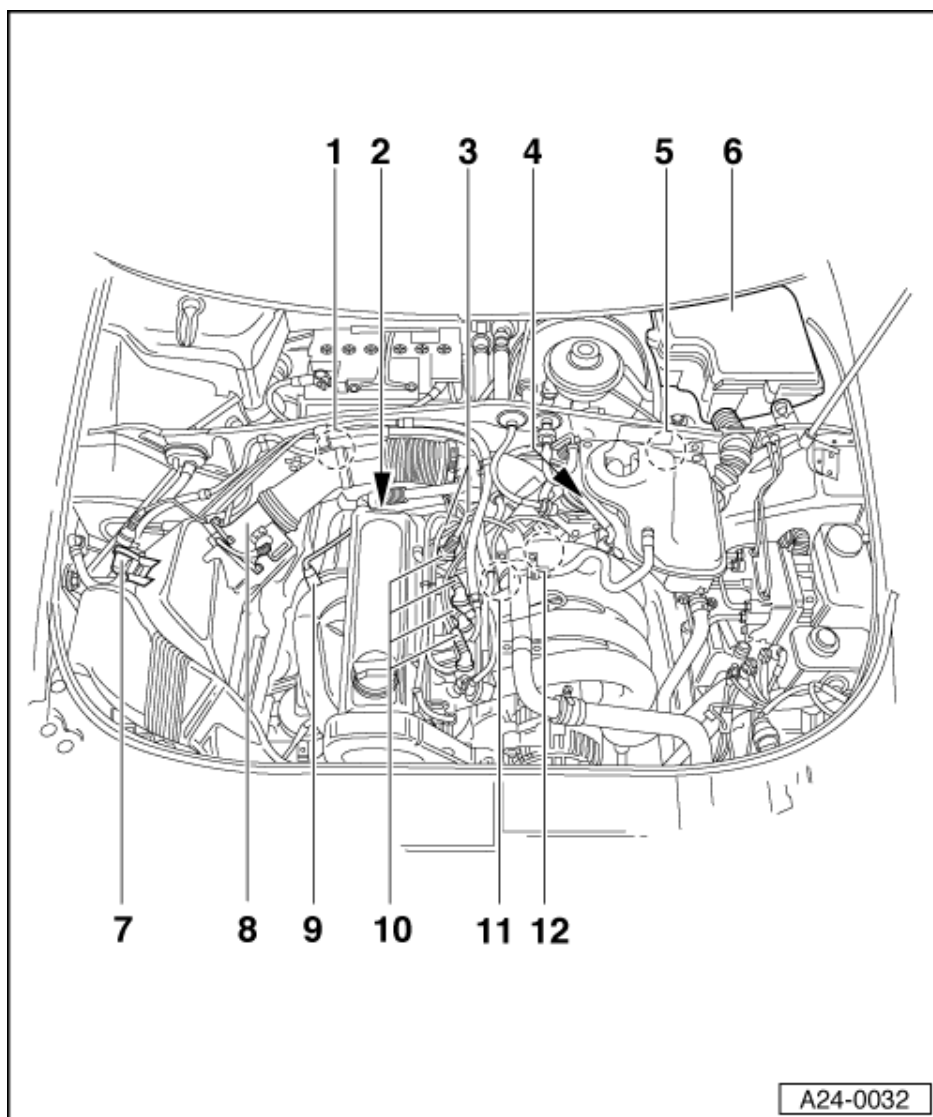
	vacuum hose disconnected	approx. 4 bar		
Holding pressure after 10 minutes		at least 2.5 bar		
Injectors	Spray pattern	Single hole nozzle	Two hole nozzle	Two hole nozzle
	Injection quantity (30 s)	85...105 ml	85...105 ml	130...150 ml
	Resistance*	14...16 ohm	11...13 ohm	11...13 ohm

*) Engine cooled down to room temperature. With the engine at operating temperature the resistance increases by approx. 4...6 ohm.

1.5 - Overview of fitting locations - engine code ADP



- 1 Power output -N7 with ignition coil -N
- 2 Coolant temperature sender -G62 (in coolant pipe at rear of cylinder head)
- 3 Distributor with Hall sender -G40
- 4 Throttle valve control part -J338
- 5 Plug connections for
 - ◆ Lambda probe (black)
 - ◆ Engine speed sender (grey)
 - ◆ Knock sensor (green)
- 6 Motronic control unit -J220

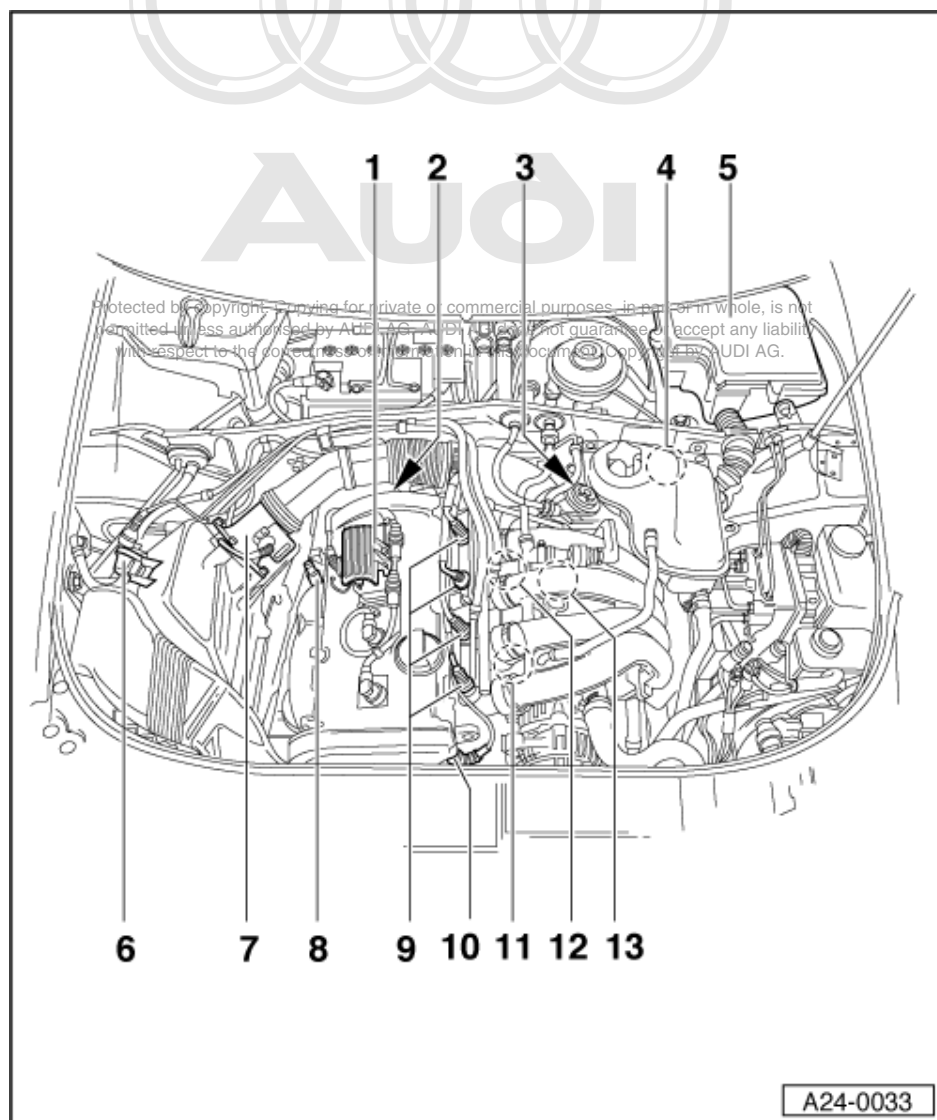


- 7 Solenoid valve for activated charcoal filter -N80
 8 Air mass meter -G70
 9 Lambda probe -G39 with lambda probe heating -Z19
 10 Injectors
 ♦ Cylinder 1 -N30
 ♦ Cylinder 2 -N31
 ♦ Cylinder 3 -N32
 ♦ Cylinder 4 -N33
 11 Knock sensor I -G61
 12 Engine speed sender -G28 (behind oil filter)

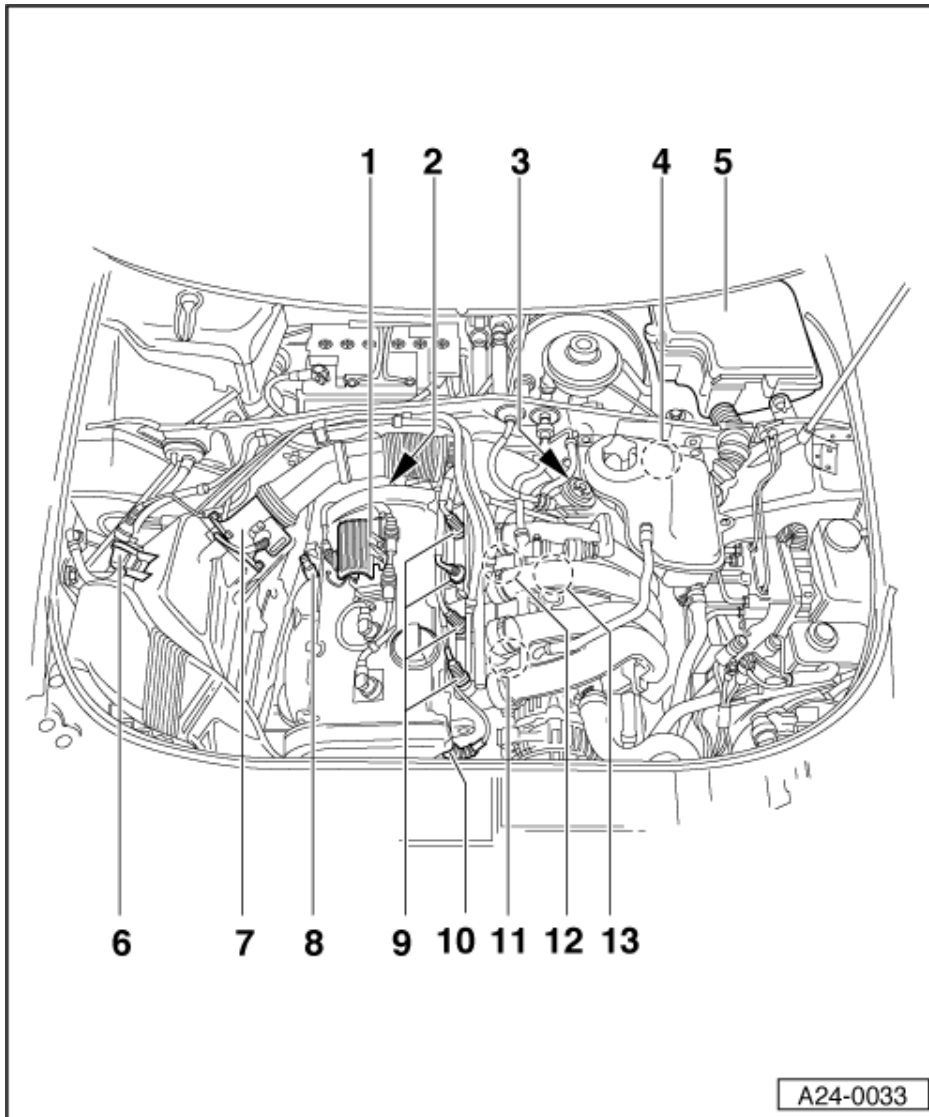
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1.6 - Overview of fitting locations - engine code ADR



- 1 Ignition coils -N and -N128 with power output stage -N122
- 2 Coolant temperature sender -G62 (in coolant pipe at rear of cylinder head)
- 3 Throttle valve control part -J338
- 4 Plug connections for
 - ◆ Lambda probe (black)
 - ◆ Engine speed sender (grey)
 - ◆ Knock sensor 1 (green)
 - ◆ Knock sensor 2 (blue)
- 5 Motronic control unit -J220
- 6 Solenoid valve for activated charcoal filter -N80

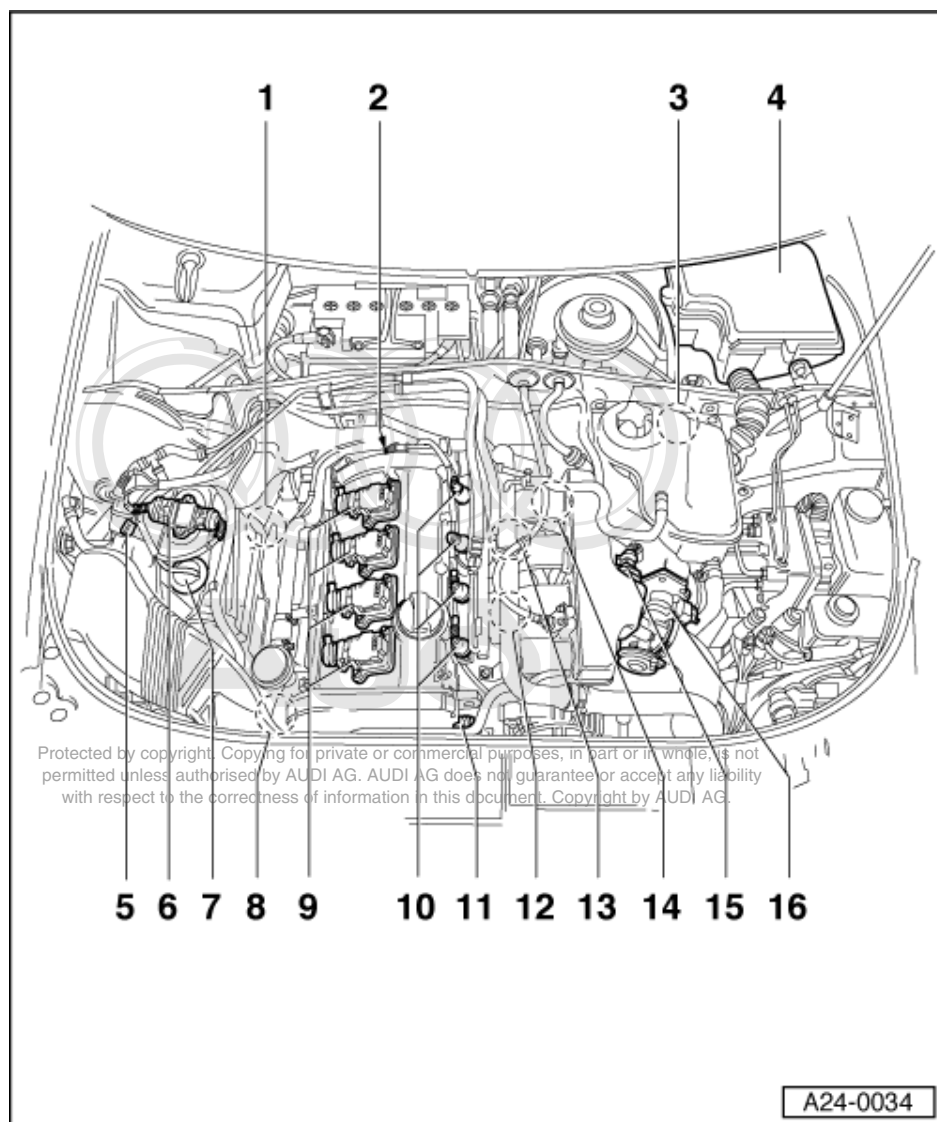


- 7 Air mass meter -G70**
- 8 Lambda probe -G39 with lambda probe heating -Z19**
- 9 Injectors**
 - ♦ Cylinder 1 -N30
 - ♦ Cylinder 2 -N31
 - ♦ Cylinder 3 -N32
 - ♦ Cylinder 4 -N33
- 10 Hall sender -G40**
- 11 Knock sensor 1 -G61**
- 12 Knock sensor 2 -G66**
- 13 Engine speed sensor -G28 (behind oil filter)**

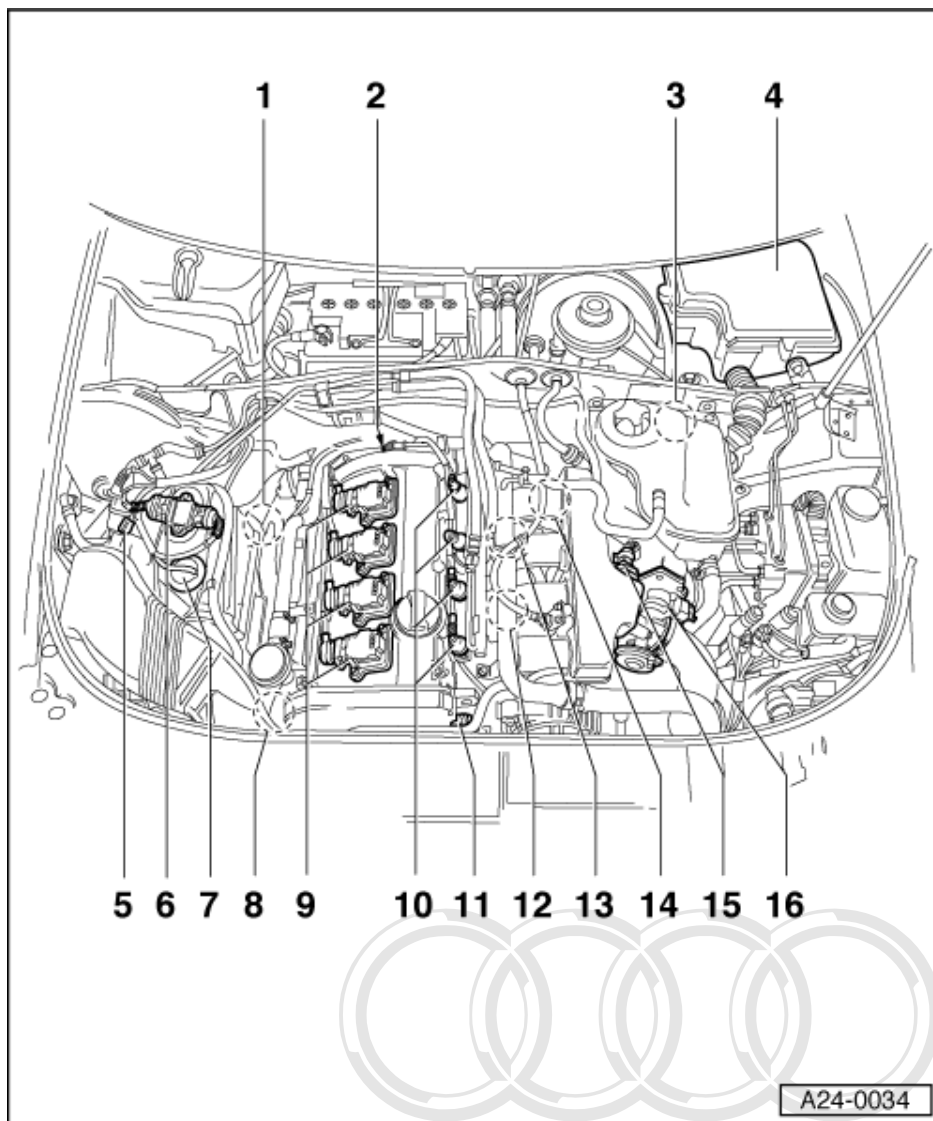
Audi

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1.7 - Overview of fitting locations - engine code AEB



- 1 Lambda probe -G39 with lambda probe heating -Z19
- 2 Coolant temperature sender -G62 (in coolant pipe at rear of cylinder head)
- 3 Plug connections for
 - ◆ Lambda probe (black)
 - ◆ Engine speed sender (grey)
 - ◆ Knock sensor 1 (green)
 - ◆ Knock sensor 2 (blue)
- 4 Motronic control unit -J220
- 5 Solenoid valve for activated charcoal filter -N80
- 6 Power output stage for ignition coils -N122
- 7 Air mass meter -G70 (in upper part of air cleaner)



8 Charge pressure control solenoid valve -N75

9 Ignition coils

- ◆ Cylinder 1 -N
- ◆ Cylinder 2 -N128
- ◆ Cylinder 3 -N158
- ◆ Cylinder 4 -N163

10 Injectors

- ◆ Cylinder 1 -N30
- ◆ Cylinder 2 -N31
- ◆ Cylinder 3 -N32
- ◆ Cylinder 4 -N33

11 Hall sender -G40

12 Knock sensor 1 -G61

13 Knock sensor 2 -G66

14 Engine speed sensor -G28 (behind oil filter)

15 Intake air temperature sender -G42

16 Throttle valve control part -J338

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1.8 - Checking idling speed and CO content

Test requirements:

- ♦ No leaks in exhaust system
- ♦ Coolant temperature at least 80 °C.
- ♦ Throttle valve in idling position (adjust accelerator cable)

=> 4-cylinder Engine, Mechanics; Repair group 20; Removing and installing parts of fuel supply system; Servicing accelerator mechanism Removing and installing parts of fuel supply system Servicing accelerator mechanism

- ♦ All electrical loads off.
- ♦ Air conditioning switched off.
- ♦ Pressure gauge not connected
- ♦ Vehicles with automatic gearbox: Selector lever in position P or N

Checking idling speed

Notes:

- ♦ The idling speed cannot be adjusted.
- ♦ The idling speed is checked in function 08 "Read measured value block".
- Interrogate fault memory =>Page 4 . The fault memory must be clear. If necessary, rectify any faults and erase the fault memory. Switch off the engine, then start up again. Take vehicle for a test drive and interrogate the fault memory again to make sure it is clear.
- Leave engine idling.
- Switch off air conditioner.
- Switch off rear window heating.
- Place selector lever in P or N position (automatic gearboxes).

Important!

The electric radiator fan must not be running.

- Read measured value block (function 08) and select Display group 05 =>Page 19 .

-> Display:

Read	measured	value	block	5
1	2	3	4	

- Read off idling speed from Display zone 1.

Specification: 820...900 rpm

- Press the ➡key
- Enter 06 for 'End output' and confirm entry with Q-key.
- If the specified result is not achieved, interrogate the fault memory again =>Page 4 .

If the idling speed is too high or too low and there are no faults recorded in the fault memory, carry out the following tests marked with a dot:

- Test idling switch =>Page 75 .
- Large quantity of unmetered air =>Basic setting of engine, Display group 01, 05 or 08.
- Check throttle valve control part =>Page 73 .

Testing CO content:

It is not possible to adjust the CO content.

It is not possible to test the CO content upstream of the CAT.

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To assess the exhaust upstream of the CAT, it is necessary to check the Lambda control values and the Lambda learned values in the self-diagnosis.

- Interrogate fault memory =>Page 4 . The fault memory must be clear. If necessary, rectify any faults and erase the fault memory. Switch off the engine, then start up again. Take vehicle for a test drive and interrogate the fault memory again to make sure it is clear.
- Leave engine idling.
- Read measured value block (function 08) and select Display group 03 =>Page 19 .

-> Display:

Read measured value block	3
1 2 3 4	

Do not proceed with the test until the coolant temperature shown in Display zone 3 has reached at least 80 oC.

- Press the C key
- Press keys 0 and 9 (Display group 09 is selected with 09) and confirm the entry with the Q key.

-> Display:

Read measured value block	9
1 2 3 4	

- Compare the displayed values to the specified values=>Page 35 .
- If the values are not as specified, rectify the fault and repeat the test.
- Press the C key
- Press keys 0 and 8 (Display group 8 is selected with 08) and confirm entry with the Q key.

-> Display:

Read measured value block	8
1 2 3 4	

- Compare the displayed values to the specified values =>Page 33 .
- If the values are not as specified, rectify the fault and repeat the test.
- Press the =>key
- Press keys 0 and 6 for "End data transfer" and confirm entry with the key Q.

1.9 - Testing fuel pressure, pressure regulator and holding pressure

Test requirements:

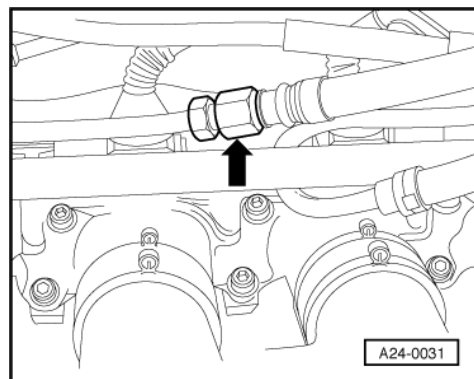
- ♦ Fuel pump relay OK, testing =>Page 63 .
- ♦ Fuel pump OK; testing:

=> 4-cylinder Engine, Mechanics; Repair group 20; Removing and installing parts of fuel supply system; Testing fuel pump Removing and installing parts of fuel supply system Testing fuel pump

Note:

Fuel pressure regulator regulates fuel pressure as a function of intake pressure.

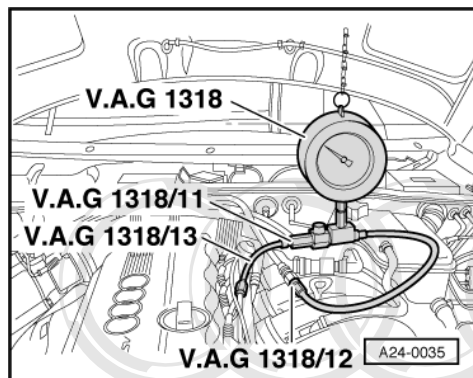
- Briefly open the fuel filler cap (to release pressure).



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- -> Cover the screw union of the supply pipe (arrow) which contains pressurised fuel with a cleaning rag to prevent fuel from splashing. Open screw union and collect fuel that flows out (place drip tray beneath cleaning rag).

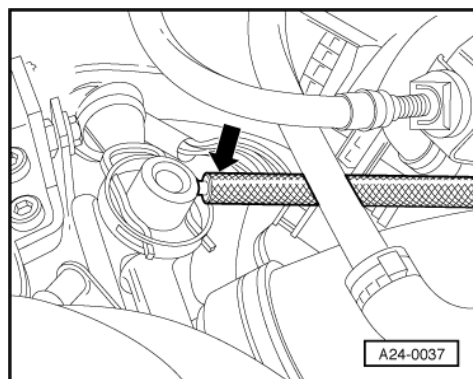


- -> Install pressure gauge V.A.G 1318 with adapters V.A.G 1318/11, 1318/12 and V.A.G 1318/13 in the supply pipe.

Note:

The shut-off cock of the pressure measuring device must be open (lever facing in the direction of flow).

- **Start the engine and run at idling speed.**
 - **Measure fuel pressure.**
 - **Specified value: approx. 3.5 bar**
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- -> Disconnect vacuum hose (arrow) for fuel pressure regulator. The fuel pressure should rise to approx. 4.0 bar.
- Re-connect vacuum hose.
- Stop engine. Immediately after switching off the engine the fuel pressure drops to approx. 3 bar.
- Test for leaks and holding pressure by watching pressure drop on gauge. After 10 minutes the remaining pressure should be at least 2.5 bar.

If the holding pressure drops below 2.5 bar:

- Start engine and, once the fuel pressure has built up, switch off again.
- Close shut-off valve at the pressure gauge V.A.G 1318.

If the holding pressure does not drop, the following faults are possible:

- Fuel pressure regulator defective
- Injectors leaking
- Unions on pressure gauge downstream of shut-off valve leaking

If the pressure drops again, the following faults are possible:

- Union between pressure gauge and fuel supply pipe leaking
- Supply pipe leaking at fuel tank

- Non-return valve in fuel pump leaking; remove fuel pump and install.

=> 4-cylinder Engine, Mechanics; Repair group 20; Removing and installing parts of fuel supply system; Removing and installing fuel delivery unit Removing and installing parts of fuel supply system Removing and installing fuel delivery unit

Note:

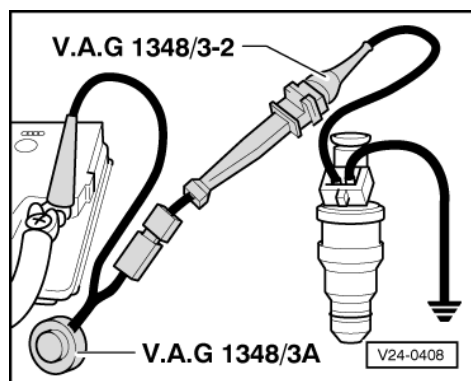
To remove the pressure gauge, close the shut-off valve, unscrew the union on adapter V.A.G 1318/12, then open the shut-off valve to drain off excess fuel into a suitable container.

1.10 - Testing injection quantity, leak tightness and spray pattern of injectors

Test requirements:

Fuel pressure OK, checking - Page 57.

- Disconnect vacuum hose from fuel pressure regulator (engine code ADR only)
- Disconnect the connectors from all the injectors.
- Disconnect the connector from the Hall sender (engine codes ADR and AEB only).
- Unbolt the fuel manifold from the intake manifold and pull it upwards and off the intake manifold together with the injectors.



- Place the injector which is to be tested into measuring glass of injection quantity tester V.A.G 1602.
- -> Connect one of the injector contacts to engine earth using test cable and crocodile clamp from V.A.G 1594.
- Connect second injector contact to positive using remote control V.A.G 1348/3 A, adapter cable V.A.G 1348/3-2 and auxiliary cable.
- Start final control diagnosis and actuate fuel pump relay -J17 =>Page 17. The fuel pump should run.
- Check injectors for leaks (visual check). When the fuel pump is running, only 1 or 2 drops a minute should escape from each injector.
- If the fuel loss is greater, switch off the fuel pump (terminate final control diagnosis) and renew the faulty injector. Removing and installing injectors =>Page 60.
- If necessary re-start the final control diagnosis.

Note:

The final control diagnosis cannot be re-started until the ignition has been switched off briefly.

- Activate the V.A.G 1348/3 A remote control for 30 seconds.
- Perform measurements on all injectors.
- Once all four injectors have been actuated, place measuring glasses on a level surface.

Engine code	Specified value
ADP and ADR	85...105 ml
AEB	130...150 ml

- If measured values for one or more injectors are outside tolerance, switch off fuel pump (terminate final control diagnosis) and replace defective injector.

- If the measured values for all the injectors are outside the tolerance range, check the fuel pressure =>Page 57.

Note:

When checking the injection quantity, also check the spray pattern. The spray pattern should be the same for all the injectors.

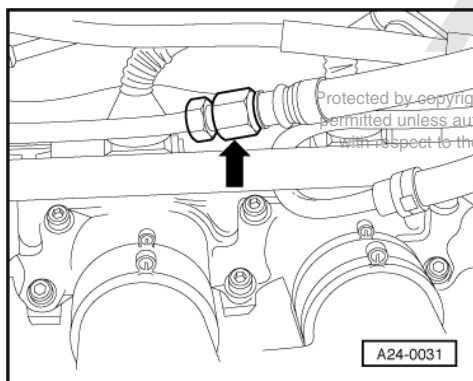
Installation of the fuel manifold together with injectors is performed in the reverse sequence. The following points should be noted when installing:

- Renew the O-rings at all opened connections. (When renewing the front O ring, make sure not to remove the plastic cap from the injector head. The O-ring must be pulled off over the plastic cap.)
- Moisten the O-rings with clean engine oil.
- Make sure that the injectors are installed in the correct positions. (With the engine codes ADR and AEB, the electrical connections are secured against twisting by a plastic part between cylinders 1 and 2 and cylinders 3 and 4).
- Check to make sure that the retainer clamps are properly seated.

1.11 - Removing and installing injectors

Removing

- Disconnect vacuum hose from fuel pressure regulator.



- Briefly open the fuel filler cap (to release pressure).
- -> Cover the screw union of the supply pipe (arrow), which contains pressurised fuel, with a cleaning rag to prevent fuel from splashing. Open screw union and collect fuel that flows out (place drip tray beneath cleaning rag).
- Disconnect the connectors from all the injectors.
- Disconnect vacuum hose from fuel pressure regulator.
- Disconnect the connector from the Hall sender (engine codes ADR and AEB only).
- Unbolt the fuel manifold from the intake manifold and pull it upwards and off the intake manifold together with the injectors.
- Withdraw the retention clamp at the injector/fuel rail connection and pull the injector out of the fuel rail.

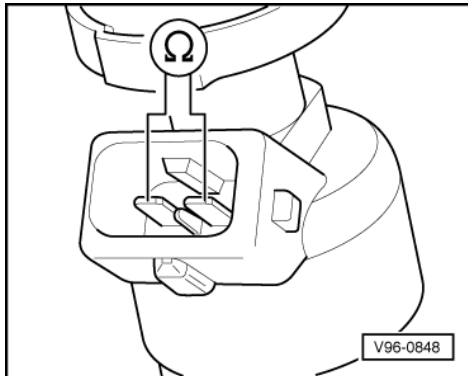
Installing

Notes:

- ♦ Fit new O-rings. (When renewing the front O ring, make sure not to remove the plastic cap from the injector head. The O-ring must be pulled off over the plastic cap.)
- ♦ Check to make sure that the retainer clamps are properly seated.
- Moisten the O-rings with clean engine oil.
- Push injectors vertically into the fuel rail until they meet a stop and secure with retainer clamps.
- Insert fuel rail with the secured injectors on the intake manifold and press in evenly until a stop is met.

- Insert securing bolts, press fuel rail gently by hand in the direction of the intake manifold and tighten securing bolts (10 Nm).
- Further installation takes place in the reverse sequence to removal.

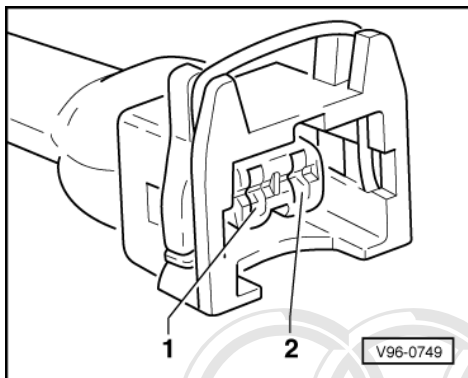
1.12 - Checking injectors



A - Electrical testing of injectors

- Remove connector from the injector which is to be tested.
- -> Measure resistance between the injector contacts using V.A.G 1526.
Engine cooled down to room temperature.
Specified value for engine code ADP: 14...16 ohm
engine code ADR: 11...13 ohm
engine code AEB: 11...13 ohm
When the engine is at operating temperature, the resistance is increased by approx. 4...6 ohm.
- If the measured value is not as specified, renew the injector. Removing and installing injectors =>Page 60.

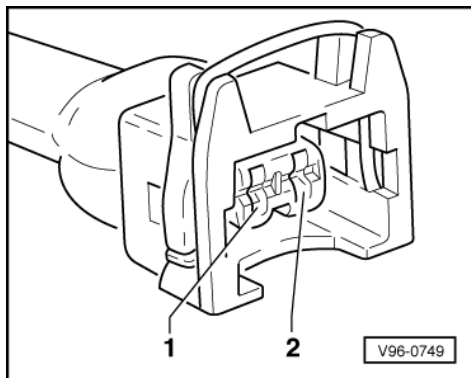
B - Testing power supply



Test requirements:

- ◆ Fuse -S34 for injectors OK.
- Remove connector from the injector which is to be tested.
- -> Connect diode test lamp V.A.G 1527 between engine earth and contact 1.
- Operate starter for a few seconds (the engine can be allowed to start). The diode test lamp should light up.
- If the diode test lamp does not light up, test for continuity in circuit from contact 1 via the fuse for the injectors -S34 to the fuel pump relay according to the current flow diagram - if necessary rectify open circuit.
- If the diode test lamp lights up, test actuation of injectors.

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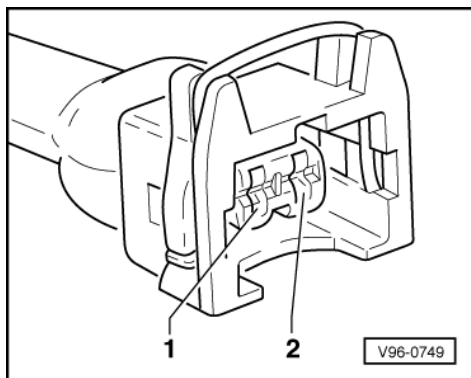


C - Testing activation of injectors

- Remove connector from the injector which is to be tested.
- -> Connect diode test lamp V.A.G 1527 between contacts 1 and 2.
- Operate starter for a few seconds (the engine can be allowed to start) - the diode test lamp must flash.

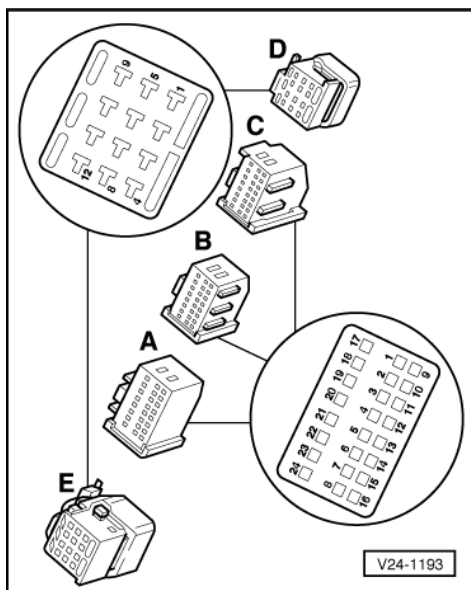
Note:

Diode test lamps with a low current consumption do not go out completely between the flashing pulses, but continue to glow slightly and become much brighter during the flashing pulses.



- If the diode test lamp does not flash, connect test box V.A.G1598/19 to the wiring harness for Motronic control unit -J220.
- -> Test for open circuit or short to positive in the wiring between the Motronic control unit and contact 2 on the plug connector for the injector being tested.

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Contact 2 on plug connector for injector	Test box V.A.G 1598/19 or - J220
1	E1
2	E6
3	E5
4	E2

- Rectify any open/short circuit as necessary.
- If the wiring is OK, replace the Motronic control unit.

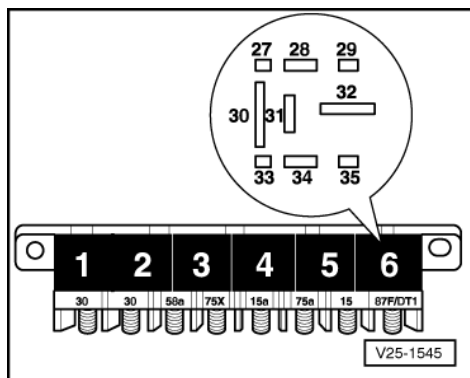
1.13 - Testing fuel pump relay and activation

Notes:

- ♦ The fuel pump relay is located in the central electrics in the left hand footwell, relay position 6.

A - Operational test of fuel pump relay -J17

- Pull out fuses 28, 29 and 34.
- Connect diode test lamp V.A.G 1527 to the relevant front contact for fuse 28 / 29 / 34 and operate the starter for a few seconds - the fuel pump relay should pick up (can be felt and heard) and the diode test lamp should light up.
- If the diode test lamp does not come on although the fuel pump relay picks up, repeat test at the rear contact of the relevant fuse.



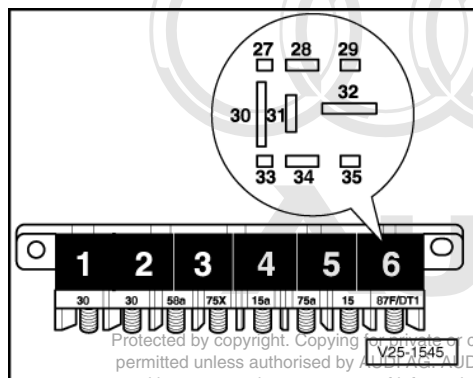
- -> If the diode test lamp still fails to come on, check the wiring between contact 30 at relay position 6 and fuse 28 / 29 and between contact 31 and fuse 34 for continuity according to the current flow diagram - rectify any open circuit(s) as necessary.
- If no open circuit is detected, replace the fuel pump relay.
- If the fuel pump relay does not pick up, test actuation =>Page 64 .
- If the voltage supply and the actuation are OK replace fuel pump.

B - Testing power supply and actuation of fuel pump relay

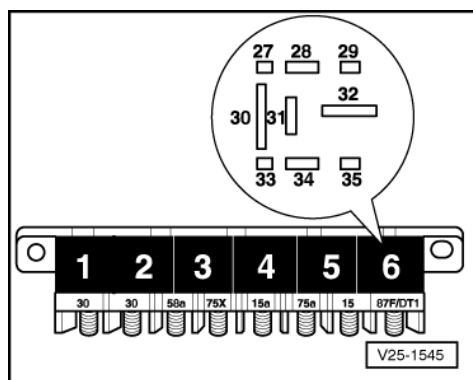
- Remove fuel pump relay -J17 from the central electronics, relay position 6.

Checking power supply

- Switch ignition on.



- -> Connect handheld multimeter V.A.G 1526 in turn between contacts 28 (positive, terminal 15) and 34 (ground), and 32 (positive, terminal 30) and 34 (ground) of the relay base.
Specified value: approx. battery voltage in each case
- If the specified values are not achieved, rectify the open circuit according to the current flow diagram and if necessary replace the central electrics.

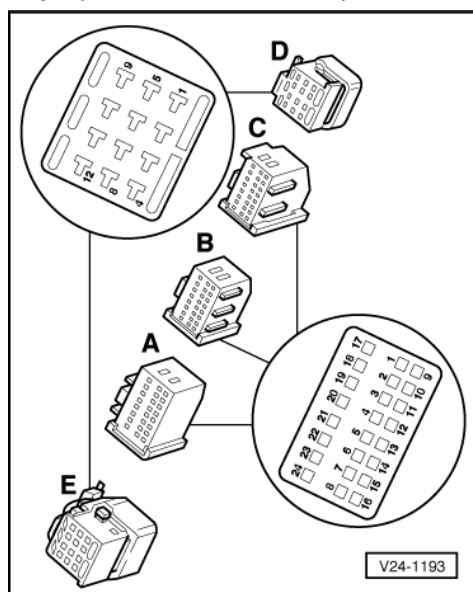


Checking actuation

- -> Connect diode test lamp V.A.G 1527 between contact 28 (positive) and 29 (ground actuation of Motronic control unit).
- The diode test lamp should light up when the starter is operated.

Note:

Diode test lamps with a low current draw glow faintly when the ignition is switched on and then light up more brightly when the starter is operated.



If the diode test lamp does not light up when the starter is operated, test the wiring as follows:

- Connect test box V.A.G 1598/19 to the wiring harness of the Motronic control unit.
- -> Connect a hand-held multimeter between contact 29 of the relay base and socket D6 of the test box and check the wiring for continuity.
- If desired value is not attained, eliminate open circuit or short circuit according to the current flow diagram.
- If there is no open circuit and the diode test lamp still does not light up, replace the Motronic control unit.
- If the actuation of the fuel pump relay and also the wiring are OK, replay the fuel pump relay.
- Put fuses 28, 29 and 34 back in.

2 - Checking lambda control

2.1 - Checking lambda control

The lambda probe compares the oxygen content in the air with the residual oxygen content in the exhaust gas and sends a voltage signal to the control unit.

The voltage signal for "Mixture rich" (low level of residual oxygen) is between about 0.7 and 1.0 V (referenced to reference ground).

The voltage signal for "Mixture lean" (high residual oxygen) is between about -0.1..+0.3 V (referenced to reference earth).

During the transition from "rich" to "lean" and vice versa ($\lambda = 1.0$), there is a voltage jump from 0.7...1.1 V to -0.1...0.3 V or vice versa.

Because of the sharp voltage jump the lambda control cannot maintain a constant ideal mixture composition of $\lambda = 1.0$. The system fluctuates continuously between "slightly too lean" and "slightly too rich".

When the engine is at normal operating temperature the control frequency when the engine is idling is at least 0.5 Hz (corresponds to 30 oscillations per minute). At fast idling (2500...2800 rpm) the control frequency should be at least 1 Hz (corresponds to 60 oscillations per minute). An oscillation comprises the voltage jump from the maximum value through the lowest value back to the maximum value.

If the voltage does not change or only changes slowly the following faults are possible:

- ◆ Slots or holes in probe head are blocked.
- ◆ Lambda probe has been subjected to excessive thermal stress.
- ◆ Probe poisoned by leaded fuel, test with "PLUMBTESMO" test strip for lead content.
- ◆ Contact resistance in signal wiring or reference ground line.
- ◆ Lambda probe too cold; lambda probe heating not working.
- ◆ Lambda control switched off (control unit has detected fault(s) on the fuel injection system => Interrogate fault memory and Read measured value block, Display group 21).
- ◆ Lambda probe damaged by contact spray or similar product. (The contact spray is drawn into the probe through the fine cavities in the electrical wiring as a result of thermal fluctuations and capillary effects.)
- ◆ Lambda probe damaged by silicone vapours (the engine draws in traces of any silicone based sealants that may have been used. These silicone traces do not burn and damage the lambda probe).

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2.2 - Engine running problems after cold start

Test requirements:

No fault stored relating to the lambda control - if necessary eliminate fault(s) and clear the fault memory.

The time that elapses before the lambda control cuts in (required probe temperature approx. 300 °C) is mainly influenced by the following factors:



- ♦ Ambient temperature (summer or winter)
- ♦ Operating conditions after starting
- ♦ Functioning of lambda probe heating

If faults occur after a cold start, check whether the problem arises before or after the lambda control cuts in.

Procedure:

Check the vehicle under cold start conditions.

- Read measured value block (function 08) and select Display group 07 =>Page **19** .

-> Display:

Read measured value block				7
1	0.475 V	3	4	

Display zone 2 will show the voltage of the lambda probe signal.

Engine cold or lambda control not running: 0.45...0.50 V.

Caution	
V.A.G 1551 should be operated by a second mechanic	

- Start engine and carry out a road test, observe Display zone 2 during the road test.

-> When the control cuts in the voltage signal should start to fluctuate around the ranges -0.1...+0.3 and +0.7...+1.1 V.

Read measured value block				7
1	0.780 V	3	4	

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Voltages of more than +0.7 V indicate a rich fuel mixture (low oxygen level in exhaust gas).

Voltages of less than +0.3 V indicate a lean fuel mixture (high oxygen level in exhaust gas).

- If the engine performance is poor before the lambda control cuts in, the lambda control is not the cause of the problem.
- If the engine performance is only poor after the lambda control has cut, check its operation =>Page **66** .

Notes:

- ♦ If the performance improves once the lambda control has cut in, this means that the lambda control is counteracting the problem (e.g. unmetered air or defective injector etc.). Check the lambda learned values to confirm this.
- Select "Read measured value block" (function 08) and Display group 08. If the values are not as specified, rectify the fault.
- Also check the measured value blocks in function 04 (Basic setting). The ACF solenoid valve -N80 is closed for this function.
- ♦ With the aid of Display group 99 it is possible to switch the lambda control on and off as required. Pressing keys 4 and 8 will switch between the "Basic setting" (lambda control off) and "Read measured value block" (lambda control on).

2.3 - Checking function

- Read measured value block (function 08) and select Display group 03 =>Page **19** .

-> Display:

Read measured value block				3
1	2	3	4	

Do not proceed with the test until the coolant temperature shown in Display zone 3 has reached at least 80 °C.

- Press the C key
- Press keys 0 and 7 (Display group 7 is selected with 07) and confirm entry with the Q key.

-> Display:

Read measured value block				7
1	2	3	4	

Display zone 2 will show the voltage of the lambda probe signal.

- If the probe voltage fluctuates very slowly, test the probe heating =>Page 67 .
- If a constant probe voltage of 0.45...0.50 V is displayed then there is an open circuit in the signal wire - check the wiring =>Page 69 .
- If a constant voltage of -0.1...+0.3 V is displayed (mixture too lean), then the mixture control has reached the control stop in the "rich" direction, but the lambda probe still detects "Mixture too lean" =>Fault table, Page 5 .
- If a constant voltage of 0.7...1.1 V is displayed (mixture too rich), then the mixture control has reached the control stop in the "lean" direction, but the lambda probe still detects "Mixture too rich" =>Fault table, Page 5 .

- Press the C key

-> Display:

Read measured value block		10	Q
Enter Display group number		XXX	

- If the lambda probe is working properly, select Display group 08 and check the lambda learned values.

-> Display:

Read measured value block		8
2ms	-0.7 %	-0.5 %
TB active		

The mixture adaptation system has learning ability, i.e. the lambda control can recognise differences between various engines (injector nozzle delivery, compression, fuel pressure etc.) and compensates by adjusting the pre programmed basic injection periods in the map in the control unit. The injection periods are extended or reduced until a mixture of $\lambda = 1$ is achieved. The deviation of the actual injection period from the basic injection period programmed in the map is given as a percentage.

- ♦ Positive learned value (+...%): Programmed basic injection period too short, actual injection period longer by ...% to achieve $\lambda = 1$.
- ♦ Negative learned value (-...%) Programmed basic injection period too long, actual injection period shorter by ...% to achieve $\lambda = 1$.

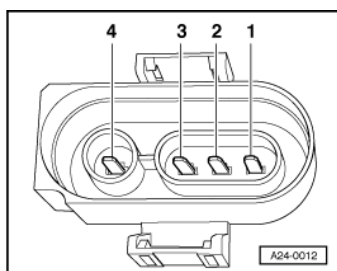
-> Display:

Read measured value block		8
2ms	-0.7 %	-0.5 %
TB active		

Specified values =>Read measured value block - Page 33

- If the specified values are not achieved =>Test table, Display group 08 - Page 34

2.4 - Checking lambda probe heating



Note for engine code AEB:

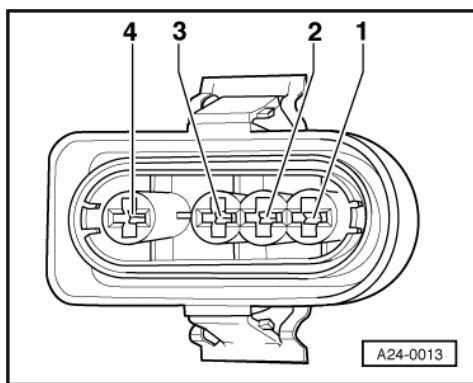
The lambda probe heating circuit is monitored by the self-diagnosis system.

- Interrogate fault memory =>Page 4 .
- Unplug connector for lambda probe
- -> Use V.A.G 1526 to test continuity (resistance measurement) between contacts 1 and 2 on lambda probe connector.

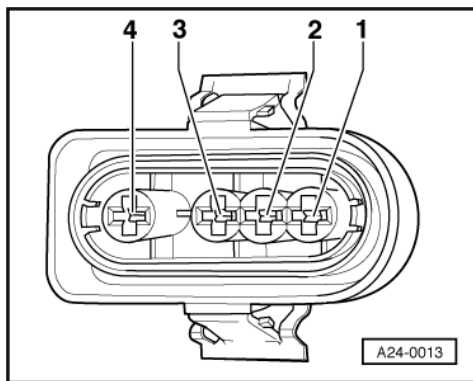
Note:

The resistance of the heating element is about 1...5 wat room temperature. Even with a small temperature increase the resistance rises sharply.

- If an open circuit is detected, fit a new lambda probe.
- If the heating element has continuity, test the power supply for the lambda probe heating as follows:
- Test fuse 29.



- -> If the fuse is OK, connect diode test lamp V.A.G 1527 between contact 1 of the connector on the wiring harness and engine ground.
- Operate the starter briefly (the engine may also start briefly). The diode test lamp should light up.
- -> If the diode test lamp does not light up, test wiring from contact 1 on connector on wiring harness to fuse for open circuit or short to ground. Rectify if necessary.
- If the fuse and the wiring are OK, but the diode test lamp still fails to light up, test the fuel pump relay =>Page 63 .

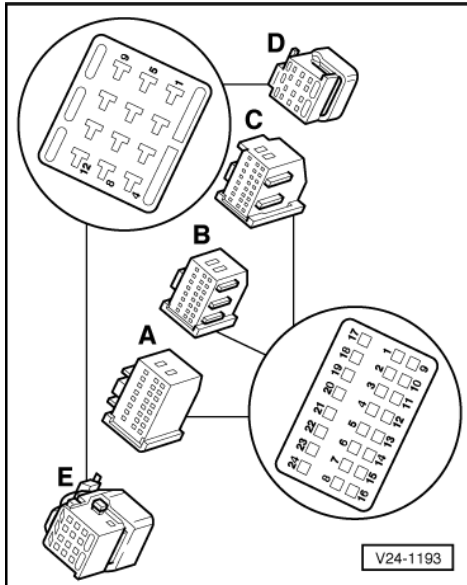


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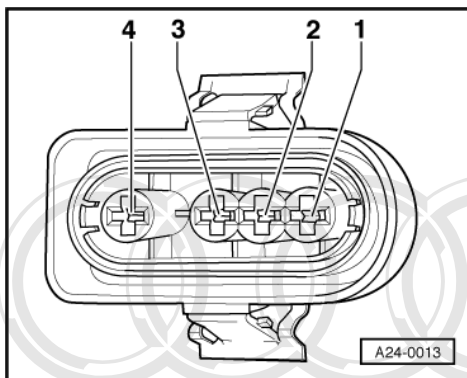
- If the voltage supply is OK, connect test box V.A.G 1598/19 to the wiring harness for the Motronic control unit.

Engine code AEB only:

- -> Check the wiring from contact 2 of the connector on the wiring harness (ground wire) to socket B7 on the test box for an open circuit or short circuit to positive or ground.



- -> If necessary repair open circuit between contact 2 of the connector on the wiring harness and contact B7.



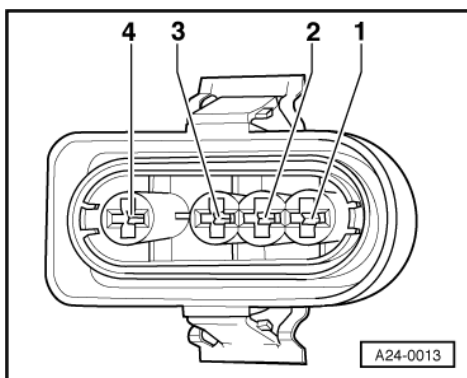
Engine codes ADP and ADR only:

- -> Check wiring from contact 2 of the connector in the wiring harness (ground wire) to engine ground for continuity, if necessary eliminate open circuit.

2.5 - Testing lambda probe signal wiring and activation

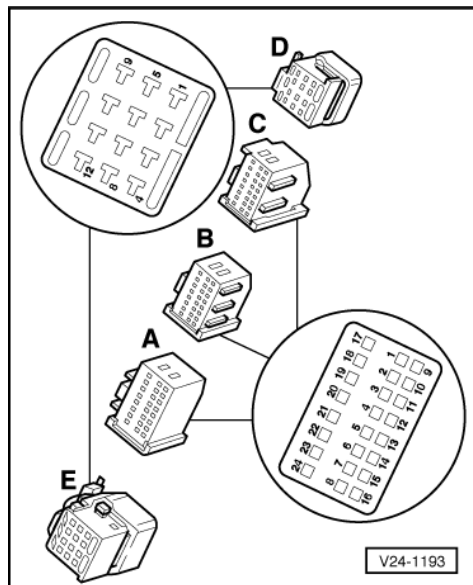
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- Interrogate fault memory => Page 4 (The lambda probe signal is monitored by the self-diagnosis function.)
- If a fault in the lambda probe has been registered and the lambda probe heating is OK, unplug the lambda probe connector.





- -> Test voltage by connecting hand held multimeter V.A.G 1526 (measuring range 2 V) between contacts 3 and 4 of connector on wiring harness.
- Switch ignition on.
Specified value: 450 ±50 mV.
- If the specified value is not achieved, connect test box V.A.G 1598/19 to the wiring harness for Motronic control unit -J220.



- -> Test the following wiring connections for open circuit or short to positive or ground and repair as necessary:

Connector on wiring harness, contact	Test box V.A.G 1598/19 or -J220
3	A10
4	A11

- If the wiring is OK, replace the Motronic control unit -J220.

2.6 - Removing and installing lambda probe

- Unplug connector for lambda probe
- Undo cable ties.
- Use V.A.G 3337/9 to unscrew lambda probe.

When installing, note the following points:

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Notes:

- ♦ When installing, the cable ties must be re-fitted at exactly the same points in order to prevent contact between the Lambda probe wire and the exhaust pipe.
- ♦ Tightening torque 50 Nm.
- ♦ The screw thread on the lambda probe is coated with assembly paste. This paste must not be allowed to penetrate the openings on the probe.

3 - Testing boost pressure control (engine code AEB only)

3.1 - Testing boost pressure control (engine code AEB only)

3.2 - Function of boost pressure control

In order to limit the boost pressure, a valve flap is opened by a pressure unit at the exhaust gas turbine. This can be used as required to allow some of the exhaust gases to bypass the exhaust gas turbine. This reduces the power output of the turbine and therefore also the delivery of the compressor.

The pressure unit on the turbocharger is actuated via a control line using tapped air from the compressor. The control pressure needs to be reduced in order to increase the boost pressure.

The pressure in the control line is reduced via boost pressure control solenoid valve -N75, which releases pressure from the control line and therefore reduces the control pressure (in order to minimise noise the air is directed into the large intake hose). Due to the low control pressure the exhaust gas valve flap remains closed for longer.

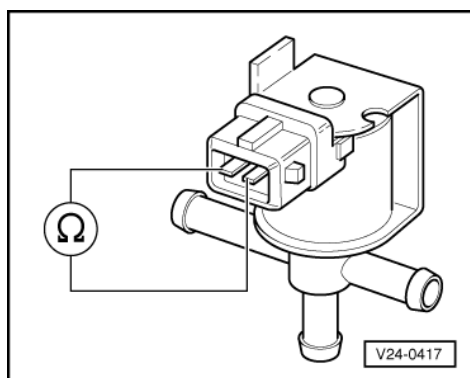
When there is no voltage on the valve, the full control pressure immediately becomes effective at the pressure unit and the boost pressure is governed down to a minimum value.

In order to lower the control pressure (with the aim of increasing the boost pressure) it is necessary for the solenoid valve to open further. This requires a current increase. This change in current is achieved by increasing the duty cycle.

3.3 - Checking solenoid valve for boost pressure control -N75

Testing for leaks

- When there is no electrical signal, the long connection is closed.
 - The two short connections are connected to each other.
 - When actuated, the link between the long connection and the two short connections is opened.
- Removing boost pressure control solenoid valve (fitting location =>Page 55 - Item 8)
 - Connect the removed valve to the wiring harness.
 - Start final control diagnosis and actuate boost pressure control solenoid valve -N75 => Page 17 .
 - Blow into the long connection during the final control diagnosis to check whether the valve opens and closes properly, if necessary replace the solenoid valve.



Electrical test of -N75

- Disconnect the plug from boost pressure control solenoid valve-N75.
 - -> Measure resistance between the valve contacts using hand-held multimeter V.A.G 1526.
- Specified value: 25...35 Ω.

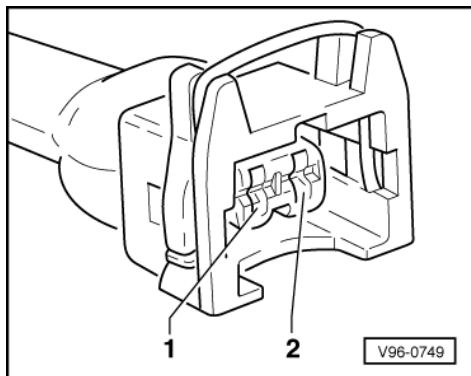


- If the specified value is not obtained, renew valve -N75.

Testing power supply of -N75

Note:

The boost pressure control solenoid valve receives its power supply via the fuel pump relay.



Test requirements:

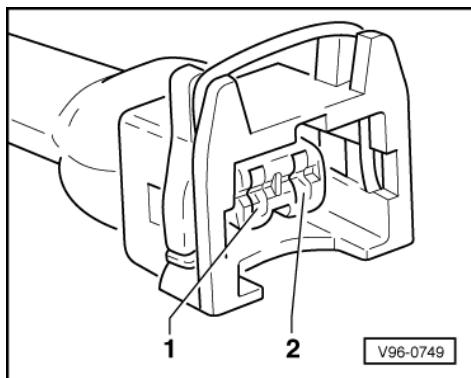
Fuse -S29 OK

- Disconnect the plug from boost pressure control solenoid valve -N75.
- -> Connect diode test lamp V.A.G 1527 between engine ground and contact 1 on the connector.
- Operate starter.

Specified value: The diode test lamp should light up.

- If the diode test lamp does not light up, test for continuity in the wiring between contact 1 and fuse -S29 according to the current flow diagram - if necessary repair open circuit.
- If wiring is OK, test fuel pump relay =>Page 63.

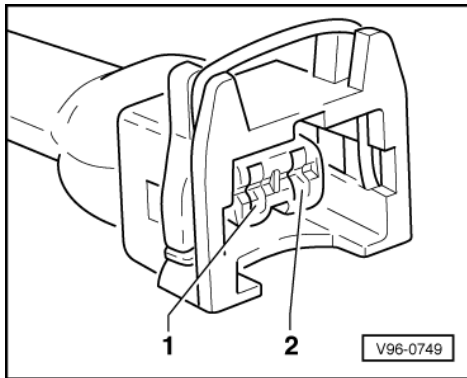
Testing actuation of boost pressure control solenoid valve -N75



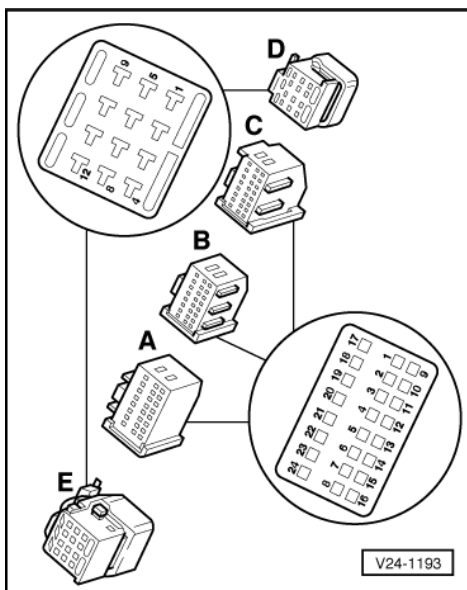
- -> Connect diode test lamp V.A.G 1527 between contacts 1 (positive) and 2 on the connector.
- Start final control diagnosis and actuate boost pressure control solenoid valve -N75 =>Page 17.

Specified value: Diode test lamp should flash.

- If the diode test lamp does not flash or it lights up permanently, connect test box V.A.G 1598/19 to wiring harness for Motronic control unit.



- -> Check wiring between contact 2 of the connector ...



- -> ... and contact D3 on the Motronic control unit for continuity or short to positive and repair as necessary.
- If no wiring fault is present, replace the Motronic control unit -J220.

4 - Testing throttle valve control part J338

4.1 - Testing throttle valve control part J338

4.2 - Function

The idling speed stabilisation is integrated in the throttle valve control part. The throttle valve potentiometer, idling speed switch, throttle valve positioner and potentiometer for throttle valve positioner are located inside the housing opposite the cable pulley. The housing must not be opened. All settings are carried out as part of the basic setting with V.A.G 1551. When de-energised the throttle valve moves into a particular, mechanically set position. The throttle valve positioner is responsible for damping the action of the throttle valve as it closes.



4.3 - Performing basic setting of throttle valve control part J338

The basic setting is used to enable the Motronic control unit to learn the stop positions of the throttle valve control part with the ignition switched on and the engine not running.
If throttle valve control part J338 is removed and installed or replaced then a new basic setting must always be performed.

Test requirements:

- ◆ Battery voltage OK.
 - ◆ Setting of throttle cable OK
 - ◆ All electrical consumers switched off
 - ◆ Setting of cruise control system, if fitted, OK
- Interrogate fault memory, eliminate any displayed faults and delete the fault memory.
 - Switch off engine and switch on ignition.
 - Select basic setting with the engine not running (function 04) and Display group 98 =>Page 44 .

Note:

After confirming Display group 98, the basic setting is started and the throttle valve positioner moves to both mechanical stops. Following this a comparison curve is calculated by means of intermediate steps.

-> Readout on display after approx. 6 seconds

Basic setting	98		
X.XXX V	X.XXX V	Idling	ADP.
OK			

The basic setting has been successfully carried out.

-> If one of the following messages appears on the display, the basic setting has been terminated.

Basic setting	98		
X.XXX V	X.XXX V	Idling	ADP.
not OK			

Basic setting	98		
X.XXX V	X.XXX V	Idling	ADP. running

Finish basic setting by pressing the =>key.

Basic setting	98		
X.XXX V	X.XXX V	Idling	ERROR

Function is unknown or cannot be carried out at the moment

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- Interrogate fault memory
- ->

No fault detected

If no fault is detected, check whether the idling switch opens and closes when the accelerator pedal is activated, Test idling switch =>Page 75 .

- ->

Idling switch does not open Short to ground
--

If one of these faults is displayed, check whether the idling switch opens and closes when the accelerator pedal is activated, Test idling switch =>Page 75 .

Idling switch does not close Open circuit.

- ->

Supply voltage
Signal too low

If this fault is displayed, test the voltage supply for the Motronic control unit (voltage at terminal 30 of the Motronic control unit has dropped below 10 V).

- ->

Throttle valve positioner sender -G127
Signal too low or too high

If one of the following faults is displayed, test the sender for throttle valve positioner -G127 and the throttle valve potentiometer =>Page 76 .

Throttle valve potentiometer -G69
Signal too low or too high

Throttle valve positioner sender -
G127
Implausible signal

4.4 - Testing idling switch

- Read measured value block (function 08) and select Display group 98 =>Page 19 .

-> Display:

Read measured value block 98
X.XXX V X.XXX V
Idling

Display zone 3 should read "Idling".

- Gradually open throttle valve.

-> Display:

Read measured value block 98
X.XXX V X.XXX V Part
throttle

Display zone 3 should read "Part throttle".

- If the specified value is not achieved, switch off the ignition and connect test box V.A.G 1598/19 to the wiring harness of the Motronic control unit.
- Measure resistance between sockets B4 and 15A using hand held multimeter V.A.G 1526.

Specified value: continuity(throttle valve closed)

- Open throttle slightly.

Specified value: idling speed switch should open (no continuity)

- If the specified value is not achieved, test wiring connections and contacts for open circuit or inspect for dirt, clean if necessary and carry out basic setting.
- If the specified value is still not achieved, check the throttle valve for dirt or stiffness and clean if necessary.
- Repeat basic setting of the throttle valve control part =>Page 74 .
- If it is not possible to start the basic setting or if the basic setting cannot be completed, fit a new throttle valve control part.
- Perform basic setting of the throttle valve control part =>Page 74 .

4.5 - Testing throttle valve positioner sender and throttle valve potentiometer

Testing sender voltage readings

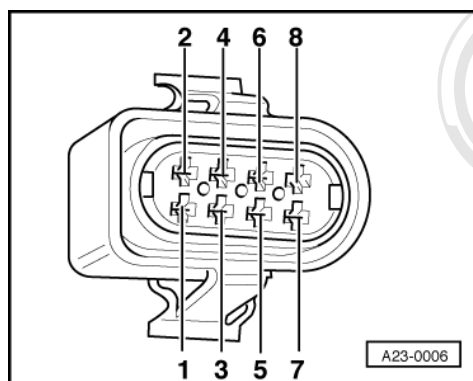
- Read measured value block (function 08) and select Display group 98 =>Page 19 .

-> Indicated on display

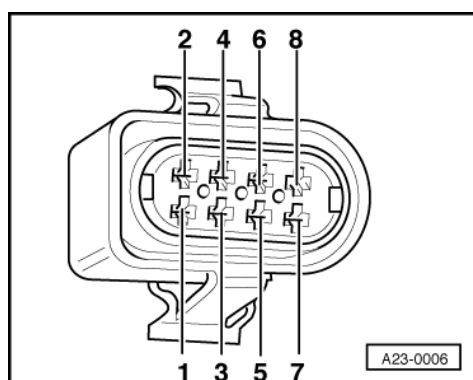
Read measured value block	98
4.420 V	3.080 V
Idling	

The values in Display zone 1 should be between 0.5 and 4.9 Volts.

- If the specified value is not achieved, switch off ignition.
- Connect test box V.A.G 1598/19 to the wiring harness of the Motronic control unit.



- Disconnect the 8-pin connector from the throttle valve control part.
- -> Use a multimeter to check the wiring between the test box and the 8-pin connector for continuity according to the current flow diagram.
Contact 1 + socket 5 D
Contact 2 + socket 1 D
Contact 5 + socket 14 A
Contact 7 + socket 15 A
Contact 8 + socket 13 A
- Use the multimeter to test the wires for short circuits with each other.



- -> If the specified values are not achieved, use a multimeter to measure the voltage between contact 4 and contact 7 on the 8-pin connector.

Specified value: at least. 4.8 V.

- Eliminate any open circuits and contamination of the contacts, delete the fault memory and perform basic setting of the throttle valve control part =>Page 74 .
- If the value is still not as specified, check the throttle valve for dirt or stiffness and clean if necessary.
- Repeat basic setting of the throttle valve control part =>Page 74 .

- If it is not possible to start the basic setting or if the basic setting cannot be completed, fit a new throttle valve control part.
- Perform basic setting of the throttle valve control part =>Page 74 .
- If the basic setting cannot be started or successfully completed, replace the Motronic control unit.
- Perform basic setting of the throttle valve control part =>Page 74 .

5 - Testing control unit input values

5.1 - Testing control unit input values

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5.2 - Testing wiring of immobiliser

Note:

The signal wire between immobiliser control unit and Motronic control unit is used both as a data wire between the control units as well as for data transfer of engine self-diagnosis.

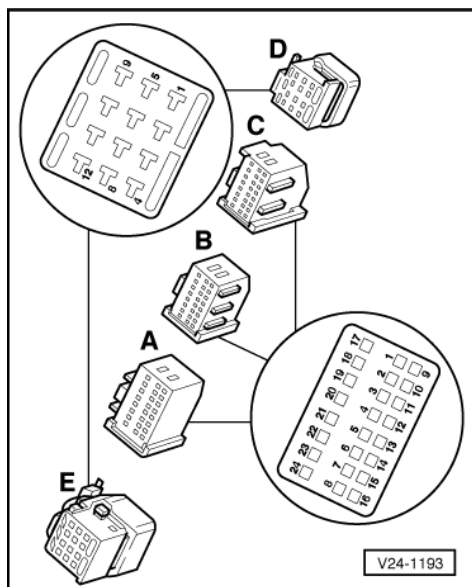
If the engine starts briefly and then cuts out again, the following faults are possible:

- Engine control unit inhibited by signal from immobiliser control unit.
 - Open circuit in signal wire from immobiliser control unit to Motronic control unit or short circuit to positive or ground.
- Interrogate fault memory =>Page 4 .

If the fault "17978, engine control unit inhibited" is displayed, there is no fault in the wiring connection. Eliminate the cause for the inhibition through the immobiliser.

=> Electrical System; Repair Group 01; Immobiliser Self-diagnosis; 02 Interrogating fault memory Immobiliser Self-diagnosis 02 Interrogating fault memory

- If the engine electronics cannot be called up because a fault is displayed in the communications build-up, then select the immobiliser with address word 25.

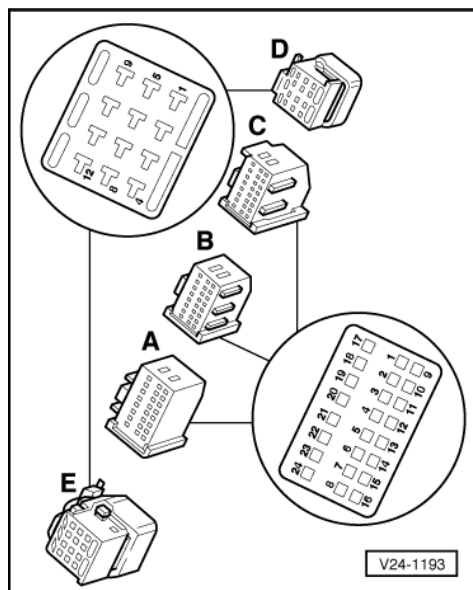


- If a fault is displayed again in the communications build-up, test the diagnostic wire - see Fault-finding program for diagnostic wires.



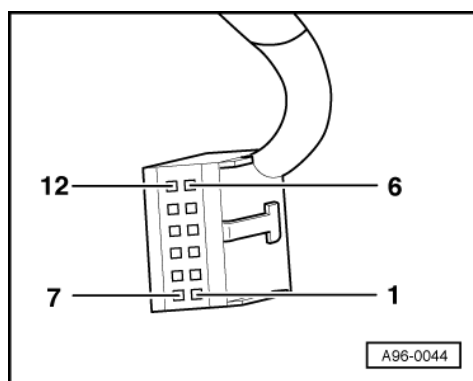
=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- -> If the immobiliser control unit sends a message then connect test box V.A.G 1598/19 at the wiring harness for the Motronic control unit.



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- -> Test wiring connection from contact A7 at the Motronic control unit ...



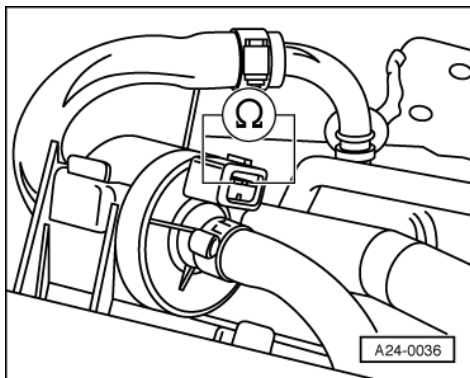
- -> ... to contact 9 on the immobiliser control unit for continuity and short to positive or ground and repair as necessary.

5.3 - Checking activated charcoal filter system solenoid valve 1 -N80

Testing for leaks

When there is no electrical supply, solenoid valve remains closed.

- Disconnect hoses from ACF solenoid valve -N80
- Connect plug to solenoid valve
- Start final control diagnosis and actuate ACF solenoid valve -N80 =>Page 17 .
- While final control diagnosis is running, blow into solenoid valve to check whether it opens and closes properly. If necessary, fit a new solenoid valve.



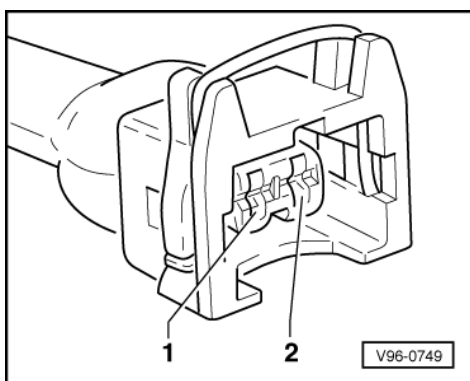
Electrical test of -N80 (ACF valve)

- Pull connector off ACF valve.
- -> Measure resistance between the valve contacts using hand-held multimeter V.A.G 1526.

Specified value: 22...30Ω.

- If the value is not as specified, fit a new ACF valve.

Testing power supply to ACF valve



Note:

The ACF valve receives its power supply via the fuel pump relay.

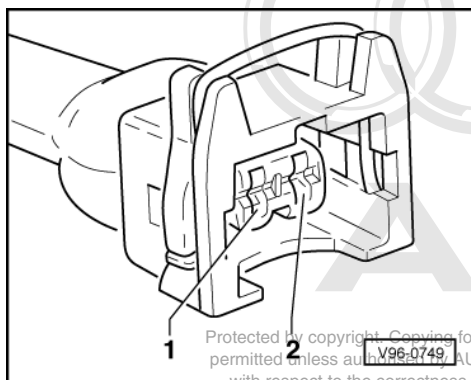
Test requirements:

- ◆ Fuse -S29 OK
- Pull connector off ACF valve.
- -> Connect diode test lamp V.A.G 1527 between engine ground and contact 1 on the connector.
- Operate starter.

Specified value: The diode test lamp should light up.

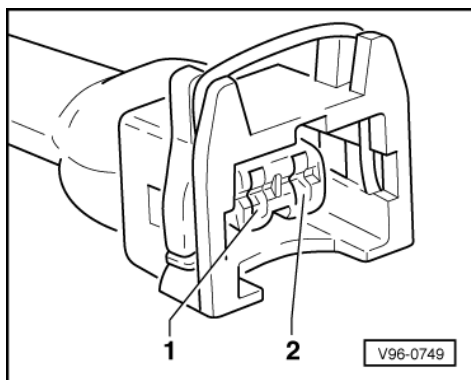
- If the diode test lamp does not light up, test for continuity in the wiring between contact 1 and fuse -S29 according to the current flow diagram - if necessary repair open circuit.
- If wiring is OK, test fuel pump relay =>Page 63.

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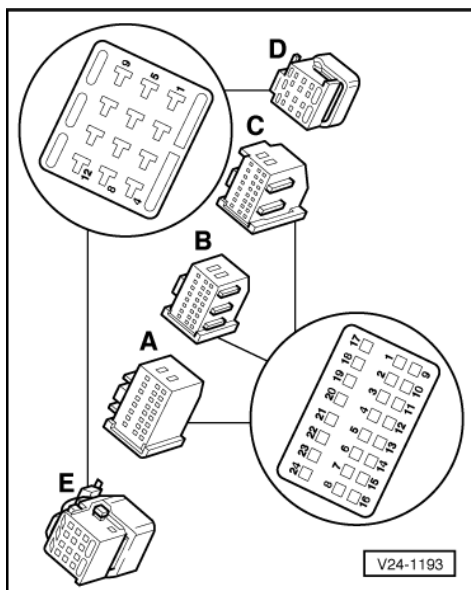


Testing ACF solenoid actuation

- -> Connect the V.A.G 1527 diode test lamp between contact 2 and contact 1 (positive) of the connector.
- Start final control diagnosis and actuate ACF solenoid valve 1 -N80 =>Page 17 .
Specified value: Diode test lamp should flash.
- If the diode test lamp does not flash or it lights up permanently, connect test box V.A.G 1598/19 to wiring harness for Motronic control unit.



- -> Check wiring between contact 2 of the connector ...



- -> ... and contact D4 on the Motronic control unit for continuity or short to positive and repair as necessary.
- If no wiring fault is present, replace the Motronic control unit.

5.4 - Checking air mass meter -G70

Note:

On engine code AEB the air mass meter is located in the upper part of the air cleaner housing.

Checking operation

- Read measured value block (function 08) and select Display group 02 =>Page 19 .

-> Display:

Read measured value block	2		
1	2	3	4

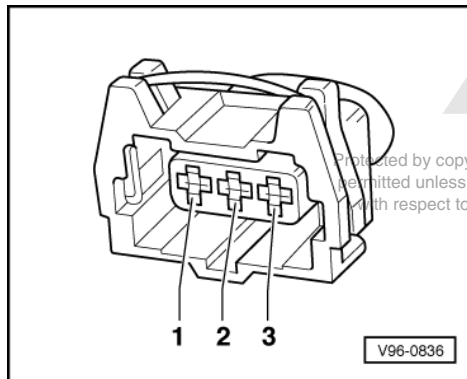
Display zone 4 will show the intake air mass (grams per second).

Specified values =>Read measured value block - Page .

- If the specified values are not attained or a fault relating to the air mass meter is stored in the fault memory, test the voltage supply =>Page 81 .

Testing voltage supply (engine codes ADP and ADR only)

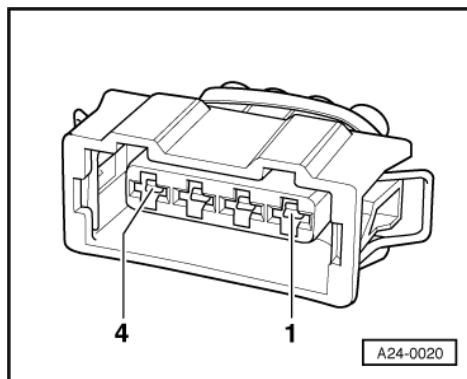
- Test fuse 29.



- -> If the fuse is OK, connect diode test lamp V.A.G 1527 between contact 3 of the connector and engine ground.
- Operate the starter briefly (the engine may also start briefly). The diode test lamp should light up.
- -> If the diode test lamp does not light up, test wiring from contact 3 on connector to fuse for open circuit or short to ground. Repair as necessary.
- If the fuse and the wiring are OK, but the diode test lamp still fails to light up, test the fuel pump relay - Page 63 .
- If voltage supply is OK, test signal wires =>Page 83 .

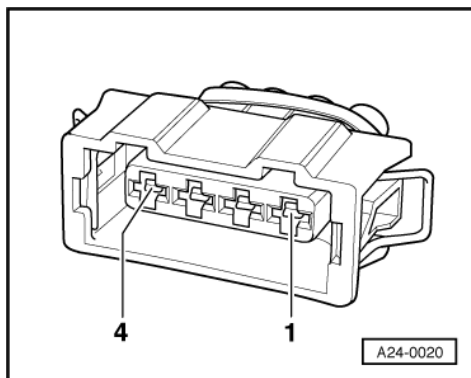
Testing voltage supply (engine code AEB only)

- Test fuse 29.

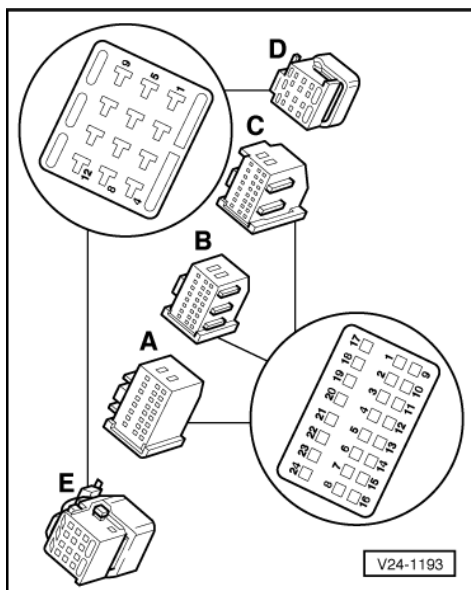




- -> If the fuse is OK, take out the rubber grommet on the cable guide on the upper part of the air cleaner housing and disconnect the plug from the air mass meter
- Connect diode test lamp V.A.G 1527 between engine ground and contact 3 on the connector.
- Operate the starter briefly (the engine may also start briefly). The diode test lamp should light up.
- -> If the diode test lamp does not light up, test wiring from contact 3 on connector to fuse for open circuit or short to ground. Repair as necessary.
- If the fuse and the wiring are OK, but the diode test lamp still fails to light up, test the fuel pump relay - Page 63 .



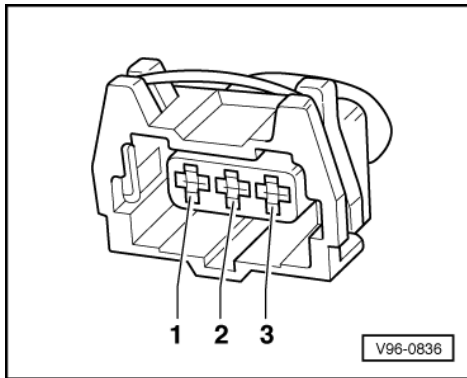
- If the voltage supply is OK, connect test box V.A.G 1598/19 to the wiring harness for the Motronic control unit -J220
- -> Check wiring between contact 1 of the connector (ground wire) ...



- -> ... and socket D11 of the test box for open circuit or short to positive and repair as necessary
- If voltage supply is OK, test signal wires =>Page 84 .

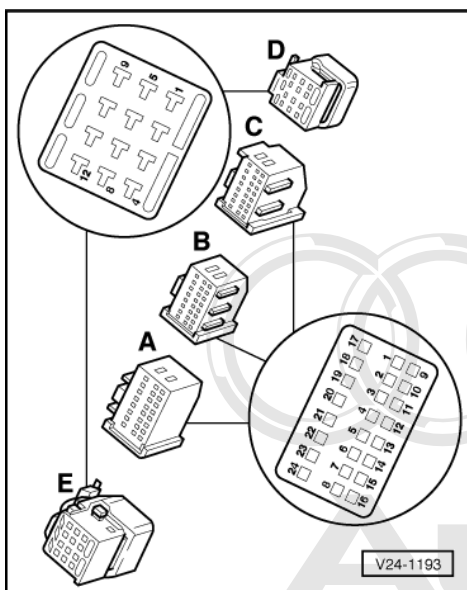


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Testing signal wire (engine codes ADP and ADR only)

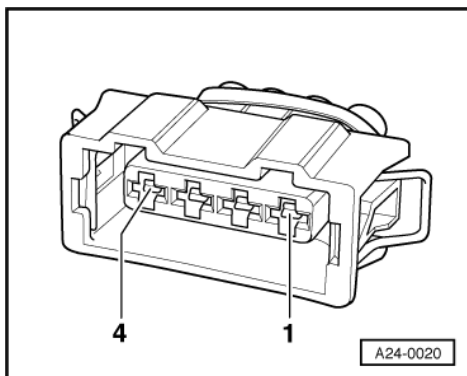
- Connect test box V.A.G 1598/19 to the wiring harness of the Motronic control unit -J220.
- Test wiring from plug connector on air mass meter ...



- -> ... to the Motronic control unit for open circuit in wiring or short circuit to positive or ground, and repair if necessary:

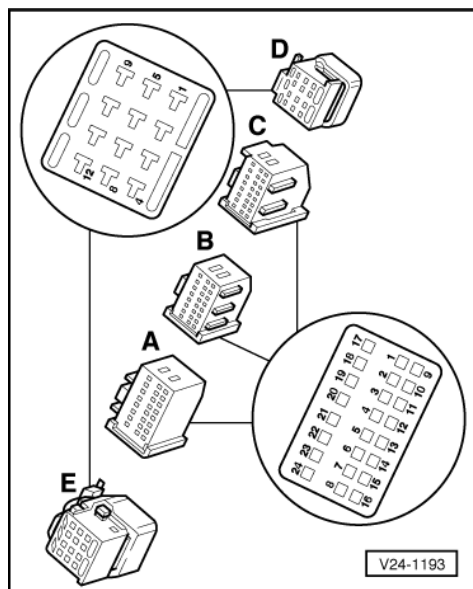
Connector for air mass meter (G70)	Test box V.A.G 1598/19 or -J220
1	A1
2	A9

- If the wiring is OK, fit a new air mass meter -G70.



Testing signal wire (engine code AEB)

- -> Connect test box V.A.G 1598/19 to the wiring harness of the Motronic control unit -J220.
- Test wiring from plug connector on air mass meter...
- ... to Motronic control unit for open circuit or short to positive or ground and repair as necessary:



Connector for air mass meter (G70)	Test box V.A.G 1598/19 or -J220
2	A9
4	A1

- If the wiring is OK, fit a new air mass meter -G70.

Note:

Only gold-plated contacts may be used for repairs in the air mass meter connector .

5.5 - Testing altitude sender - engine code AEB

The signal from the altitude sender influences

- ♦ the boost pressure control

The boost pressure control prevents the turbocharger from over-revving when the altitude increases and consequently the air density decreases.
Due to the reduction in air density (reduction in air pressure), the turbocharger needs to work harder (higher rotational speed) to deliver the required boost pressure.
This results in a higher charge air temperature and an increased risk of engine knocking. To avoid this, the boost pressure is limited.

- ♦ Mixture composition during engine start:

The richness of the starting mixture is preset by map data in the Motronic control unit and corrected with increasing altitude (decreasing air density due to decreasing air pressure) by a "lean" adjustment determined by the altitude sender.

Note:

The altitude sender is located in the electronics box next to the Motronic control unit.

Testing altitude sender signal

- Read individual measured value (function 09) and select channel 06.

-> Display:

Read individual measured value	
Channel 06	measured value 193

Specifications:

Altitude: in m	Air pressure in mbar	Signal volt- age	Channel 06 Measured val- ue
0	1013	4.0 V	204
400	970	3.7 V	188
1000	900	3.0 V	153
2000	800	2.1 V	107
3000	700	1.3 V	66

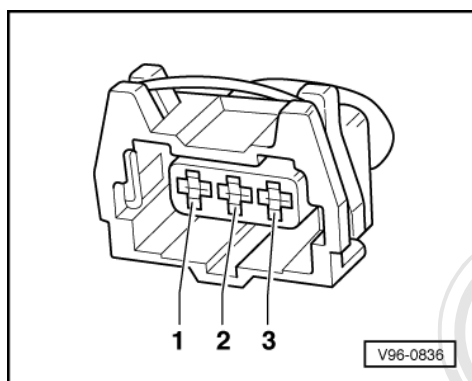
Pressure variations due to weather changes are not taken into account.

- Measure the current air pressure using turbocharger tester V.A.G 1597/A (absolute pressure display) and compare it to the measured value from channel 06.
- If the measured value from channel 06 deviates so much that it seems implausible for the altitude / air pressure, check the wiring for contact resistance and if necessary, replace the altitude sender.

Checking wiring

Note:

The altitude sender is monitored by the self-diagnosis system =>Fault table, fault code 00528 - Page

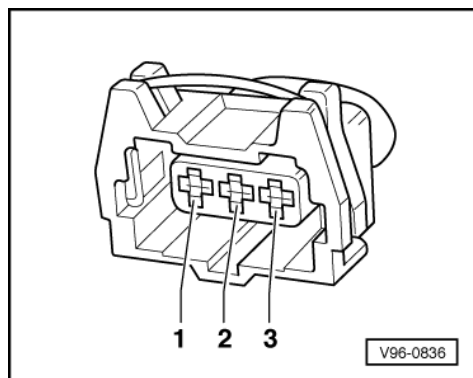


- Disconnect the plug from the altitude sender.
- -> Measure the voltage with a hand-held multimeter V.A.G 1526 in turn between the contacts 1 + 3 and 2 + 3.

Specified value: 4.5...5.5 V in each case

- If one of the specified values is not met turn off the ignition.
- Connect test box V.A.G 1598 with adapter cable V.A.G 1598/19 to the wiring harness for the Motronic control unit.

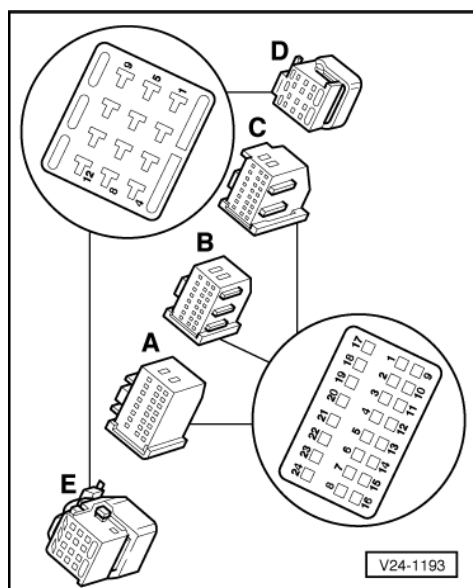
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- -> Check the following wiring connections for continuity and short circuits according to the current flow diagram:

3-pin connector, contact	V.A.G 1598/19, socket
1	C9
2	C6
3	C2



- -> If necessary rectify open circuit or short circuit according to the current flow diagram
- If the wiring is OK replace the altitude sensor.
- If after replacing the altitude sensor an implausible value is obtained again, replace the Motronic control unit.

6 - Checking auxiliary signals

6.1 - Checking auxiliary signals

A/C compressor shut-off

Notes:

- ♦ In order to ensure that the full engine power is available under acceleration, the A/C compressor is shut off for a few seconds via connection C11 on the Motronic control unit.

- ◆ Connection C11 on the Motronic control unit switches the positive signal coming from the air conditioner to ground and thus triggers the compressor shut-off.

Test requirements:

- Air conditioning functioning properly.
- No faults recorded in air conditioner fault memory
- Interior temperature of more than +15 °C

Procedure:

- Connect the fault reader V.A.G 1551 => Page 2
- Start engine
- Select "Read measured value block" (function 08) and Display group 20.

-> Display: Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without prior authorisation by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.
Read measured value block 20
 1 2 3 4

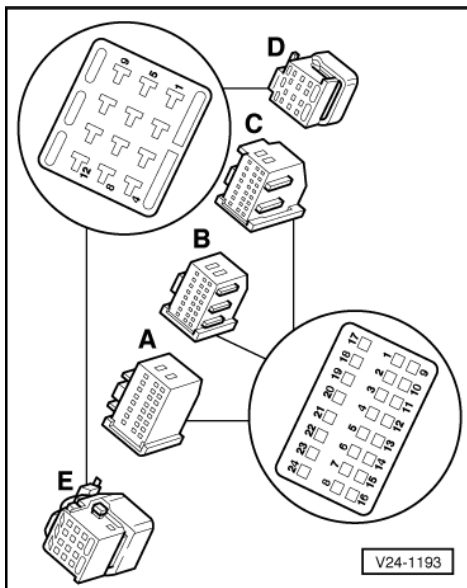
Specified value in Display zone 4 with the air conditioner switched off: Compr. OFF

- Switch the air conditioner on with the "Auto" button The compressor must run (ice crystal on the display of the A/C operating unit)

Specified value: "A/C Low" or "A/C High" in Display zone 3 and "Compr. ON" in Display zone 4

- Depress accelerator suddenly and release again (brief blip of throttle).

When the accelerator is floored quickly, the readout in Display zone 4 should jump from "ON" to "OFF" for a few seconds (compressor shut off during acceleration).



- -> If the display is not as described, switch off the engine and connect test box V.A.G 1598/19 to the wiring harness for Motronic control unit -J220 =>Page 48.
- Test wiring from contact C11 at Motronic control unit to A/C operating unit (-E87) according to the current flow diagram for short to ground or positive or for open circuit.
- If no fault is present in the wiring check the function of the A/C operating unit (-E87).

=> Air conditioning; Repair Group 01; Self-diagnosis for air conditioning Self-diagnosis for air conditioning

Engine speed adaptation through switching on the air conditioner

Notes:

- A positive signal is applied to the connection C14 on the Motronic control unit when the air conditioner is switched on or the rear window heating is switched on.
- The signal causes the Motronic control unit to maintain a constant idling speed despite the varying power requirement of the air conditioner.
- On vehicles with an automatic gearbox the idling speed changes from approx. 860 rpm to approx. 780 rpm when a gear is engaged. Both engine speeds are kept constant when the air conditioner is switched on.

Test requirements:

- Air conditioning functioning properly.
- No faults recorded in air conditioner fault memory
- Interior temperature of more than +15 oC

Procedure:

- Connect fault reader V.A.G 1551 => Page 2.
- Start the engine (operating temperature)
- Switch off heated rear window
- Select Read measured value block (function 08) and Display Group 20.

-> Display:

Read measured value block				20
1	2	3	4	

Display zone 1: Idling speed

Display zone 3: Signal from air conditioner

Display zone 4: Signal from air conditioner compressor

- Switch the air conditioner on with the "Auto" button The compressor must run.

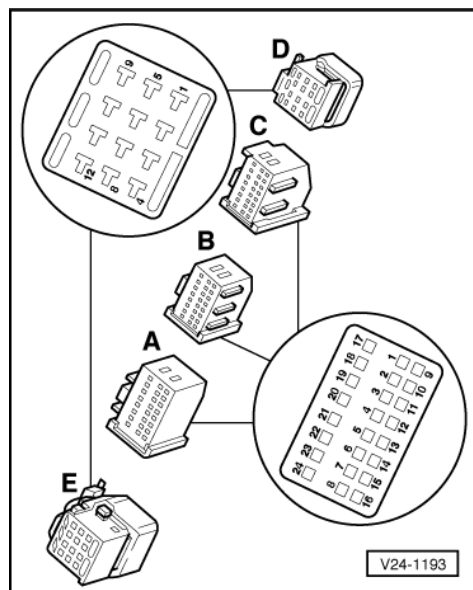
Specified value for Display zone 4: Compr. ENG"

Apart from a brief drop (less than 1 second) in rpm, the idling speed should remain constant.

If the engine speed is not kept constant, check whether the signal from the air conditioner is arriving at the Motronic control unit (Display zone 3).

Specified value for Display zone 3: "A/C Low" or "A/C High"

Specified value for Display zone 4: Compr. ENG"



- -> If the signal is not arriving, switch off the engine and connect test box V.A.G 1598/19 to the wiring harness for the Motronic control unit =>Page **48** .
- Check the wiring from contact C14 at the Motronic control unit to the A/C operating unit (-E87) according to the current flow diagram for open circuit or short circuit.
- If no fault is present in the wiring check the function of the A/C operating unit.

=> Air conditioning; Repair Group 01; Self-diagnosis for air conditioning Self-diagnosis for air conditioning

Engine speed adaptation through switching on the heated rear window

Notes:

- ♦ A positive signal is applied to the connection C14 on the Motronic control unit when the air conditioner is switched on or the rear window heating is switched on.
- ♦ The effect of this signal is that the Motronic control unit maintains idling speed at a constant level despite the additional load.
- ♦ On vehicles with an automatic gearbox the idling speed changes from approx. 860 rpm to approx. 780 rpm when a gear is engaged. Both engine speeds are kept constant when the heated rear window is switched on.

Procedure:

- Connect V.A.G 1551 =>Page **2** .
- Start the engine (operating temperature)
- Switch off the air conditioner
- Select Read measured value block (function 08) and Display Group 20.

-> Display:

Read measured value block	20
1 2 3 4	

- Display zone 1: Idling speed
- Display zone 3: rear window heater signal

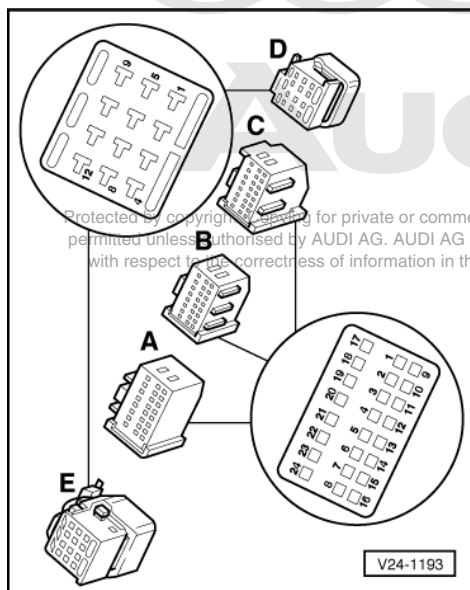
Note:

- ♦ As both the signal from the air conditioner and the signal from the heated rear window arrive at connection C14 of the Motronic control unit, Display zone 3 contains either "A/C Low" or "A/C High".
- Switching on the heated rear window

Apart from a brief drop (less than 1 second) in rpm, the idling speed should remain constant.

If the engine speed is not kept constant, check whether the signal from the heated rear window is arriving at the Motronic control unit (Display zone 3).

Specified value for Display zone 3: "A/C Low" or "A/C High"



- If the signal is not arriving, switch off the engine and connect test box V.A.G 1598/19 to the wiring harness for the Motronic control unit => Page 48 .
- Connect diode test lamp between socket D11 (ground) and C14.
- Switch on ignition and rear window heater.

When the rear window heater is switched on, the diode test lamp should come on.

- -> If the diode test lamp does not light up, check the wiring between connection C14 on the Motronic control unit and the switch of the heated rear window according to the current flow diagram for open circuit.

Selector lever position of the automatic gearbox

Note:

- ♦ The multifunction switch -F125 on the gearbox switches ground to connection B11 on the Motronic control unit when P or N is engaged.
- ♦ When a gear is engaged the switch is open and a positive voltage is applied at connection B11 of the control unit.

Procedure:

- Connect the fault reader V.A.G 1551 => Page 2 .
- Switch ignition on.
- Select "Read measured value block" (function 08) and Display group 20.

-> Display:

Read measured value block				20
1	2	3	4	

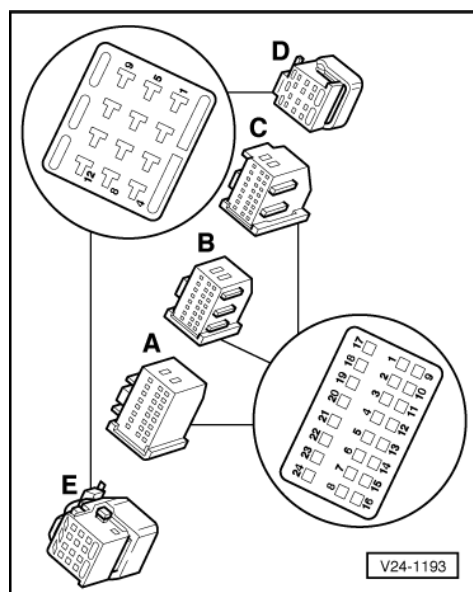
Specified value for Display zone 2: "Neutral" (selector lever in P or N)

- Depress the brake pedal and engage a gear.

Specified value: "Gear ENG"

- If the display is not as described, connect test box V.A.G 1598/19 to the wiring harness for Motronic control unit -J220 => Page 48 .
- Connect a diode test lamp between socket D9 (permanent positive, terminal 30) and B11.
- The diode test lamp should go out when a gear is engaged.
- If the diode test lamp goes out even though the display in the measured value block was not OK, check the signal for the selector lever lock.

=> Automatic gearbox 01V; Repair Group 01; Gearbox Electrical testing Gearbox Electrical testing

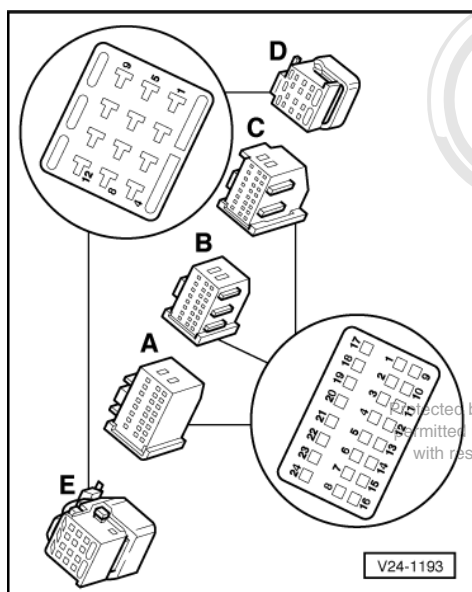


- -> If the diode test lamp is permanently lit up or not lit up at all, check the wiring between contact B11 on the Motronic control unit and the multifunction switch according to the current flow diagram for short to positive or ground and for open circuit.
- If there is no fault in the wiring, check the multifunction switch

=> Automatic gearbox 01V; Repair Group 01; Gearbox: Electrical testing Gearbox: Electrical testing

Engine speed signal

Notes:



- ♦ The engine speed signal is sent to connection C10 of the Motronic control unit. The signal is used (among others) for the control unit of the automatic gearbox for calculation of the gearshift timing and for the speedometer display in the dash panel insert.

Procedure:

- -> Connect test box V.A.G 1598/19 to the wiring harness of the Motronic control unit -J220 =>Page 48 .
- Test for open circuit in wiring between dash panel insert and contact C10 using the current flow diagram.

Throttle valve position

Notes:

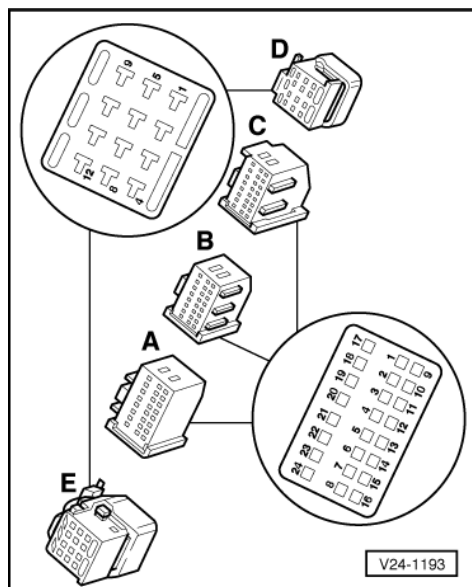
- ♦ This signal is used by the control unit of the automatic gearbox in conjunction with the engine speed to calculate the gearshift timing.
- ♦ This signal is a pulse-width modulated square-wave signal (duty cycle), which is output by the Motronic control unit at contact B1.

Procedure:

- Connect V.A.G 1551 =>Page 2 .
- Start self-diagnosis on gearbox control unit.

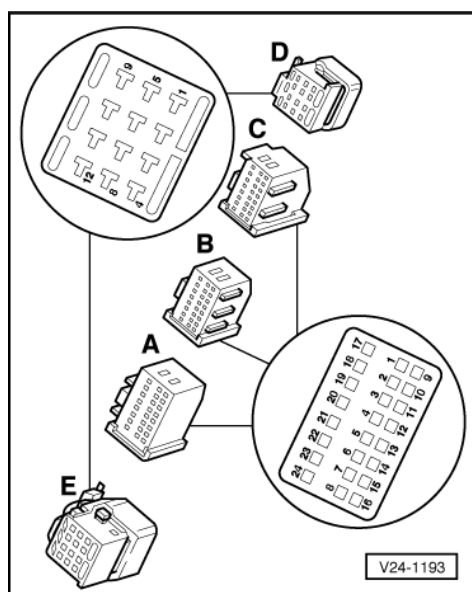
=> Automatic gearbox 01V; Repair group 01; Self-diagnosis Self-diagnosis

- If fault 00638 "Engine/gearbox electrical connection 2" is displayed by the gearbox control unit, read out fault memory of Motronic control unit => Page 2 .
- If the Motronic control unit has recorded a fault relating to the throttle valve potentiometer, rectify this fault first. (In this case the fault in the gearbox is a result of the fault in the potentiometer).



- -> If no fault is displayed relating to the throttle valve potentiometer, connect test box V.A.G 1598/19 to the wiring harness for the Motronic control unit => Page 48 .
- Test for open or short circuit in wiring between contact B1 and gearbox control unit using the current flow diagram.

Fuel consumption signal for trip computer



Note:

- ♦ The fuel consumption signal for the trip computer is output to connection C12 of the Motronic control unit.

Procedure:

- Observe operation of the on-board computer when the engine is running (instantaneous consumption).
- -> If no readout at all appears: Stop engine. Remove Motronic control unit and connect V.A.G 1598/19 to wiring harness for Motronic control unit. Check for open circuit or short in wiring between contact C12 and connection 1 (multiplug connection, black 20-pin, on dash panel insert) using hand-held multimeter V.A.G 1526 according to the current flow diagram .

Vehicle speed signal

Notes:

- ♦ The vehicle speed signal is generated by the road speed sender -G68 (on the gearbox) and is processed in instrument cluster (dash panel insert).
- ♦ The processed signal goes to contact C13 on the Motronic control unit and is used for idling speed stabilisation and for the damping of load change jolts when changing gear on the automatic gearbox.
- ♦ The idling speed stabilisation is activated below 15 km/h and with the idling switch closed.

Procedure:

- Connect V.A.G 1551 and start the dash panel insert self-diagnosis

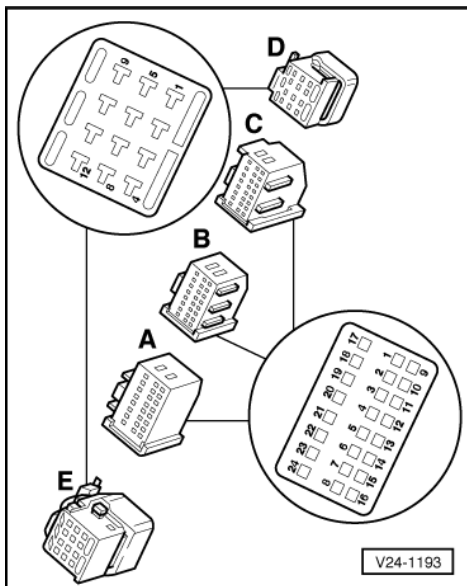
=> Electrical System; Repair Group 01; Self-diagnosis Self-diagnosis

- Select "Read measured value block" (function 08) and Display group 01.

-> Indicated on display

Read measured value block 01

- Take vehicle for a test drive and check whether the vehicle speed appears in Display zone 1.
- If the vehicle speed is not displayed, raise vehicle at front left until the wheel is clear of the ground.



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- -> Connect test box V.A.G 1598/19 to the wiring harness of the Motronic control unit =>Page 48 .
- Connect the diode test lamp between socket D9 (positive) and C13 (signal).
- Switch on ignition and rotate front left wheel by hand.
- The diode test lamp should flash (very brief flashes).

Note:

- ♦ If necessary, hold the front right wheel to prevent it from turning.
- If the diode lamp does not flash, check for open circuit or short circuit in the wiring between connection C13 on the connector for the Motronic control unit and the dash panel insert according to the current flow diagram.

Ignition angle retardation during gearshifts

Note:

- ♦ Due to this signal from the gearbox control unit, the ignition angle is briefly retarded (torque reduction) by varying amounts depending on the vehicle speed and engine speed during gearshifts on the automatic gearbox, in order to reduce juddering gear changes.
- ♦ The signal is a square-wave signal which is received at connection B9 on the Motronic control unit.



- ♦ As the signal is very short, the ignition timing retardation demand from V.A.G 1551 (Display zone 3) is not always detected.

Procedure:

- Connect the fault reader V.A.G 1551 => Page 2 .
- Perform a road test and read measured value block (function 08) and select Display group 19 =>Page 40 .

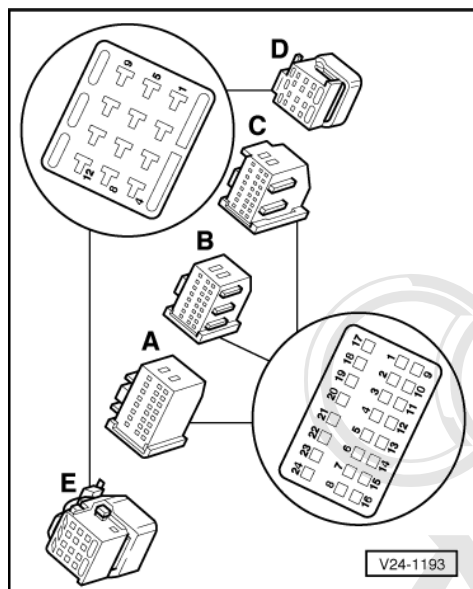
Caution

The V.A.G 1551 must be operated by a second person.

-> Display:

Read measured value block	19
1 2 3 4	

- Display zone 3 shows the ignition timing retardation demanded by the automatic gearbox for the gearshift (specified value).
- Display zone 4 shows the effective ignition timing (actual value). This value cannot however be used for evaluation, as it constantly changes according to the engine speed and load.



- The wiring to the gearbox control unit is monitored by the self-diagnosis system (fault 00545) => Page 4 .
- -> If during a gearshift there is no display in the measured value block for the torque reduction, or if fault 00545 is displayed, connect test box V.A.G 1598/19 to the wiring harness for the Motronic control unit =>Page 48 .
- Check for open circuit or short in the wiring between connection B9 of the Motronic control unit and connection 13 of the gearbox control unit according to the current flow diagram.

28 - Ignition system

1 - Checking ignition system

1.1 - Checking ignition system

The engines are equipped with different ignition systems.

- ♦ Engine code ADP: Distributor ignition system
- ♦ Engine code ADR: Double spark ignition system with two ignition coils
- ♦ Engine code AEB: Individual ignition coils for every cylinder

Note:

Overview of fitting locations => Page 50.

1.2 - Technical data for ignition system

Engine code letters	ADP
Engine speed sender	Resistance approx. 450 ... 1000 ohm
Notes: ▪ Ignition timing is determined by the control unit. ▪ Ignition timing cannot be adjusted.	
Basic setting of distributor* Display value on V.A.G. 1551 in function 04, "Basic setting, Display group 17, Display zone 3"	Test value 0 ± 120
	Setting: 0 ± 30
Spark plugs (tightening torque 30 Nm)	Part no. 101 000 033 AF101 000 051 AA NGK BKUR 6 ETBOSCH F7 LTCR
Electrode gap	0.7 ... 0.9 mm 0.9 ... 1.1 mm
Firing order	1-3-4-2
Spark plug connectors	4 ... 6 kohm
Suppresser	0.6 ... 1.4 kohm
Engine speed limitation by Motronic system Shut-off engine speed	6500 / min

*) Testing and adjusting basic setting => Page 98.

Engine code letters	ADR
Engine speed sender	Resistance approx. 450 ... 1000 Ohm
Notes: ▪ Ignition timing is determined by the control unit. ▪ Ignition timing cannot be adjusted.	
Spark plugs (tightening torque 30 Nm)	Part no. 101 000 033 AF101 000 051 AA NGK BKUR 6 ETBOSCH F7 LTCR



Engine code letters	ADR
Electrode gap	0.7 ... 0.9 mm0.9 ... 1.1 mm
Firing order	1-3-4-2
Spark plug connectors	Resistance approx. 2 kohm
Engine speed limitation by Motronic system shut-off engine speed	6800 rpm

Engine code letters	AEB
Engine speed sender	Resistance approx. 1.0 kohm
Notes: ▪ Ignition timing is determined by the control unit. ▪ Ignition timing cannot be adjusted.	
Spark plugs (tightening torque 30 Nm)	Part no.101 000 033 AB101 000 051 AB NGK BKUR 7 ETBOSCH F6 LTRC
Electrode gap	0.7...0.9 mm
Firing order	1-3-4-2
Spark plug connectors	Resistance approx. 2 kohm
Engine speed limitation by Motronic system shut-off engine speed	6800 rpm

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1.3 - Safety precautions for the Motronic system

Pay attention to the following points when carrying out work on vehicles fitted with the Motronic system in order to avoid injuries to persons and/or damage to the Motronic control system.

- ♦ For radios with anti-theft coding, ask for code before disconnecting battery.
- ♦ Always switch off the ignition before connecting or disconnecting the battery, otherwise the Motronic control unit may be damaged.
- ♦ Wait at least 30 seconds after switching off the ignition before disconnecting the plugs of the Motronic control unit, as otherwise the Motronic control unit can be damaged.
- ♦ Always switch off the ignition before connecting or disconnecting ignition system wiring or tester cables.
- ♦ For assisted starts with a rapid charging unit the maximum permissible voltage is 16.5 V and the maximum charging time is 1 minute.
- ♦ Always switch off the ignition before washing the engine.
- ♦ Vehicles that have an actual or suspected fault in the ignition system, must not be towed unless the connector at the power output stage is unplugged.
- ♦ To run engine at starting speed (for example, in order to test compression), unplug connector from the output stage of the ignition coils and also the connectors on the injectors.
- ♦ Do not operate the starter if the injectors are removed.
- ♦ Always use measuring aids set V.A.G. 1594 to connect the measuring equipment.

Engine codes ADP and ADR

- ♦ Never touch or disconnect the ignition cables whilst the engine is running at normal speed or starting speed.

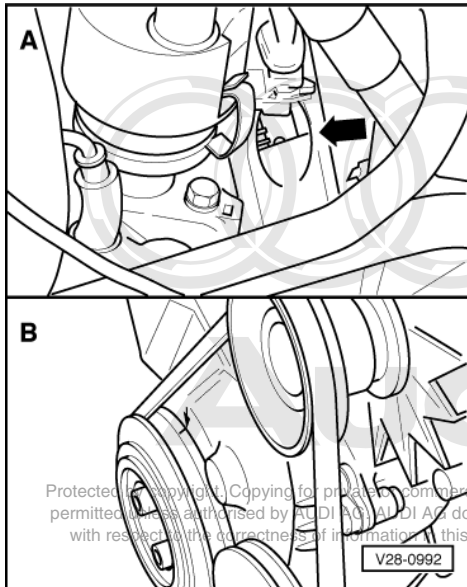
Engine code ADP

- ♦ Do not connect a capacitor to terminal 1 (-).
- ♦ Do not replace the distributor rotor 1 kw(Identification: R1) with a different type even for radio interference suppression.

2 - Testing distributor ignition system (ADO engine)

2.1 - Testing distributor ignition system (ADO engine)

2.2 - Installing distributor

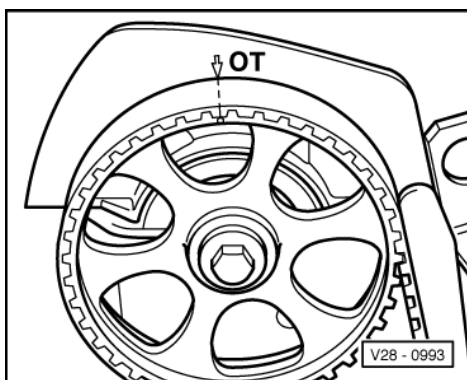


A - Engine installed

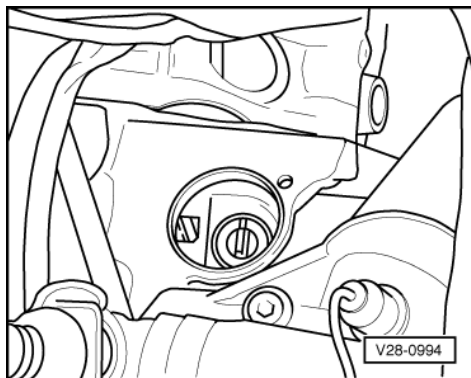
- -> Set flywheel to TDC on cylinder no. 1.

B - Engine removed

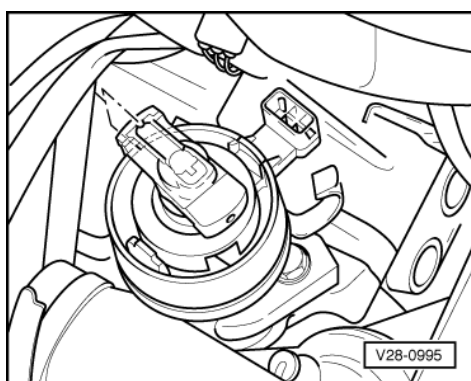
- The marking on the vibration damper (belt pulley) should be aligned with the arrow on the toothed belt guard.



- -> The marking on the camshaft sprocket should be aligned with the arrow on the top toothed belt guard.



- -> Position mounting stud of oil pump shaft parallel to the crankshaft.



- -> Position distributor rotor arm so that it points toward the marking for cylinder 1 on the distributor housing.
- Insert distributor.
- Before fitting, clean distributor cap and check for cracks and signs of tracking, renew if necessary.
- Testing and adjusting basic setting of distributor => Page 98.

2.3 - Testing and adjusting basic setting of distributor

- Interrogate and delete fault memory => Page 44. No faults must be stored (if necessary, rectify fault, erase fault memory, switch off and re-start engine, perform test drive and interrogate the fault memory again as a check).
- Leave engine idling after interrogating the fault memory.
- Start basic setting of engine up to display "Basic setting 17" => Page 44.

-> Display:

Basic setting 17			
1	2	3	4

Do not proceed with the test until the coolant temperature has reached at least 80 °C.

- Read off the display in display zone 3.

Specified values: Test value 0 ± 120

Adjustment value 0 ± 30

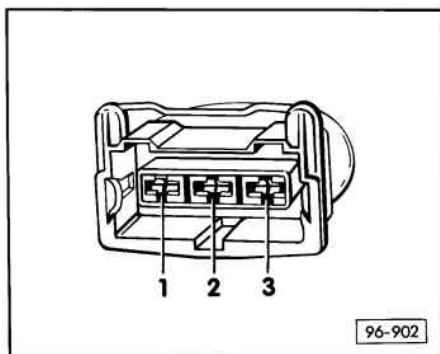
The specified value in Display zone 3 can be achieved by rotating the distributor.

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2.4 - Checking output stages for ignition coils

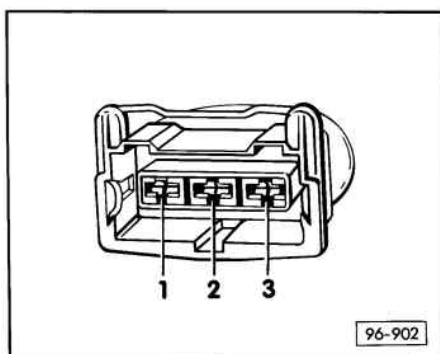
Test requirements:

- ♦ Ignition coil OK; checking =>page 101 .
- ♦ Fuse -S32 OK.



Checking power supply

- Disconnect plug from output stage -N70 and ignition cable from ignition coil.
- -> Connect hand-held multimeter V.A.G. 1526 (voltage measurement) in turn between contact 1 (positive) and engine ground and then contact 3 (ground) and 1 (positive).
- Switch ignition on.
Specified value: approx. battery voltage in each case
- If the values are not as specified, rectify the open circuit according to the current flow diagram.

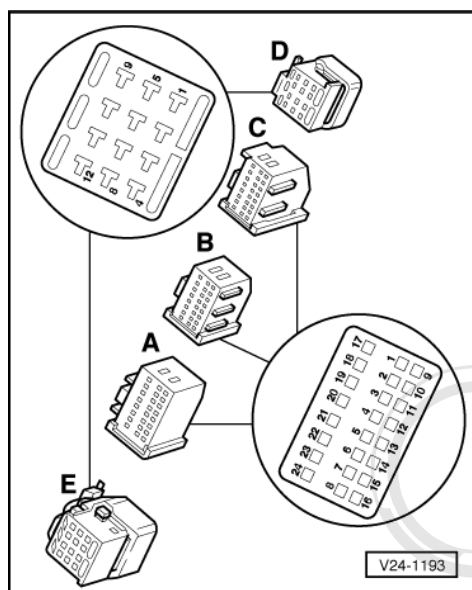


Checking actuation

Test requirements:

- ♦ Hall sender-G40 OK - testing => Page 113 .
- Disconnect the connectors from all the injectors. It is important to ensure that no fuel is injected during the test, as this would damage the catalytic converter.
- -> Connect diode test lamp V.A.G. 1527 to contacts 2 (signal) and 3 (ground) of the connector.

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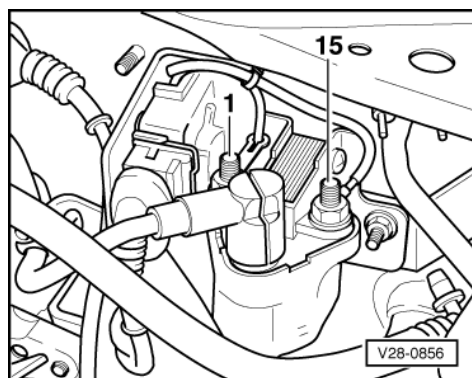


- Operate starter.
Specified value: Diode test lamp should flash.
- If diode test lamp does not flash, check wiring between connector and Motronic control unit -J220 according to current flow diagram for continuity and short circuits.
- -> Rectify any open/short circuit as necessary.

Contact at 3-pin connector of output stage	Test box V:A G 1598/19 or -J220
2	B5

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- If the wiring is OK and the diode lamp does not flash, replace the Motronic control unit.
- If the diode lamp flashes, switch off the ignition and connect the plug to the ignition coil.



- -> Connect the diode lamp with adapter cables and clamps to contacts 1 and 15 of the ignition coil.

Note:

During the following test do not touch the terminals of the ignition coil or test wires.

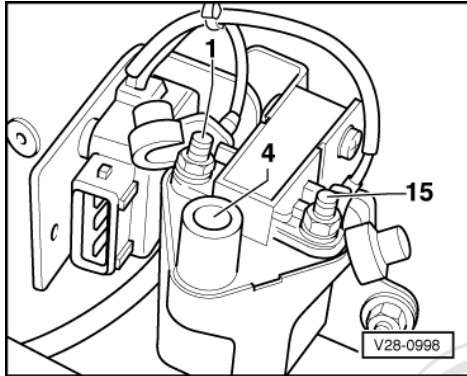
- Operate starter.
Specified value: The diode lamps must flicker.
- If the diode lamps do not flicker, replace output stage -N70.

2.5 - Checking ignition coil -N

Note:

Check wiring between output stages and ignition coil for corrosion and damage.

- Disconnect plug from output stage and ignition cable from ignition coil.



- -> Use hand-held multimeter V.A.G 1526 to test primary resistance between terminals 1 and 15.
Specified value: 0.5 ... 1.5 Ω .
- Use hand-held multimeter V.A.G 1526 to test secondary resistance between terminals 4 and 15.
Specified value: 5 ... 9 $k\Omega$.
- If one of the specified values is not attained, disconnect the ignition coil from the output stage.
- Repeat check.
- If one of the specified values is not attained replace the ignition coil.

3 - Testing double spark ignition system with two ignition coils (ADR engine)

3.1 - Testing double spark ignition system with two ignition coils (ADR engine)

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Test requirements:

- ♦ Fuse -S32 OK - test.
- ♦ Spark plug connectors OK - test.
(Resistance approx. 2 $k\Omega$).
- ♦ Ignition cables OK - test.

Ignition coils and output stage form a joint component.

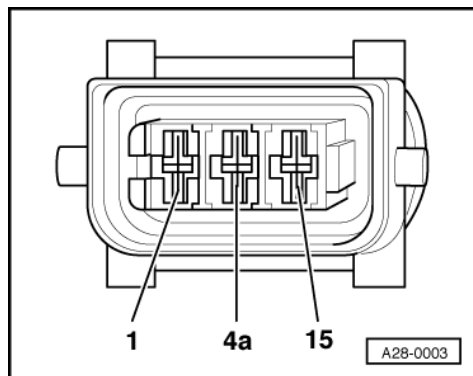
This component cannot be tested by conventional measurement media/methods.

If there is a fault in the ignition system, carry out the following test:

- Test power supply => Page 102
- Test actuation of the output stage => Page 102 .
- If neither of these tests reveals any fault and no ignition spark exists, replace power output stage together with ignition coils.



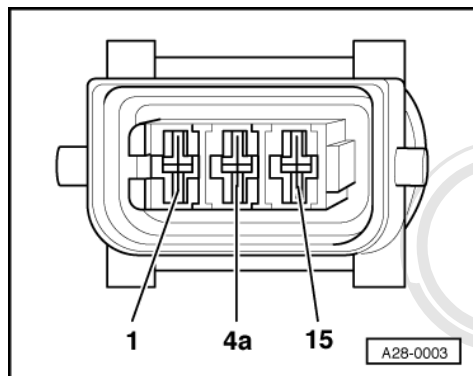
3.2 - Checking power supply



- Disconnect plug from output stage.
- -> Connect diode test lamp V.A.G 1527 to contact 4a and engine ground.
- Switch on ignition, the diode test lamp should come on.
- If the diode test lamp does not light up, check the wiring between contact 4a and fuse -S32 according to the current flow diagram.

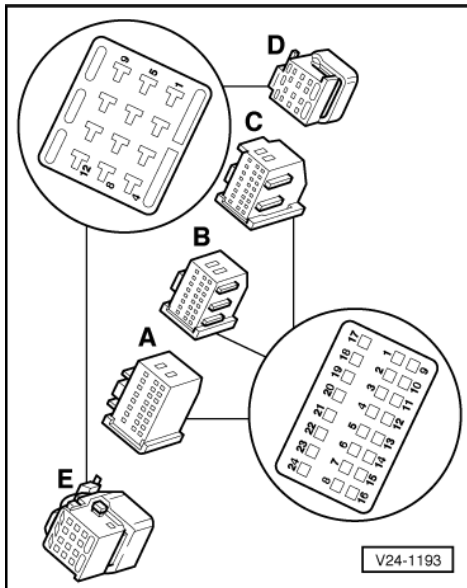
3.3 - Testing actuation of power output stage -N122

- Disconnect the connectors from all the injectors. It is important to ensure that no fuel is injected during the test, as this would damage the catalytic converter.
- Disconnect plug from output stage.



- -> Connect diode lamp V.A.G 1527 in turn to contact 1 and engine ground, followed by contact 15 and engine ground.
- Operate starter each time- the diode test lamp should flash during both these tests (one short pulse for each engine revolution).
- -> If diode test lamp does not flash, check wiring between 3-pin connector and Motronic control unit -J220 according to current flow diagram for continuity and short circuits and if necessary eliminate open circuit or short circuit.

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Contact at 3-pin connector of output stage	Test box V.A.G 1598/19 or -J220
1	B13
15	B5

- If the wiring is OK and the diode lamp does not flash, replace the Motronic control unit -J220.

4 - Testing individual coil ignition system (AEB engine)

4.1 - Testing individual coil ignition system (AEB engine)

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4.2 - Checking ignition coils

- Interrogate fault memory => Page 4 .

Test requirements:

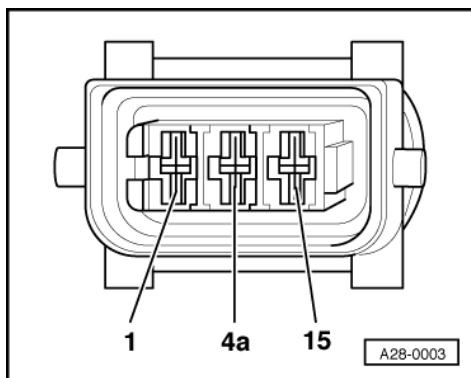
No fault stored relating to the injectors

- Unplug the connectors on the injectors with the engine running to establish which cylinder is malfunctioning/misfiring.

Note:

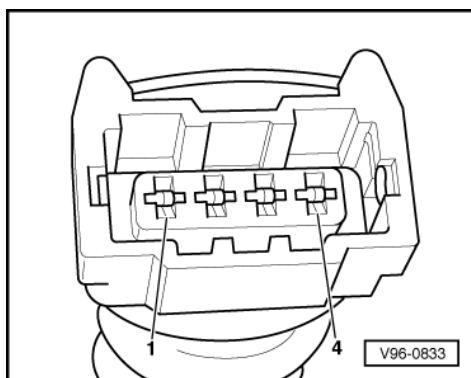
A cylinder that is misfiring or cannot operate can also be detected by comparing the spark plugs (soot on spark plug).

- Test spark plug connectors Specified value: approx. 2 kw
If the specified value is not achieved, replace the spark plug connector.
- Swap the spark plug with one from a cylinder that is working.
- If the fault now occurs at the other cylinder, renew the spark plug.
- If the fault occurs on the same cylinder, swap the ignition coil with one from a cylinder that is working.



- If the fault now occurs at the other cylinder, renew the defective ignition coil.
 - -> If the fault occurs at the original cylinder again, check the ground wire for the secondary circuit between contact 4a of the connector for the relevant ignition coil and engine ground for an open circuit.
 - If the ground connection is OK, check the primary wiring and the voltage supply, plus the output stage for the ignition coils
- => Page 105 .

4.3 - Testing primary wiring and voltage supply



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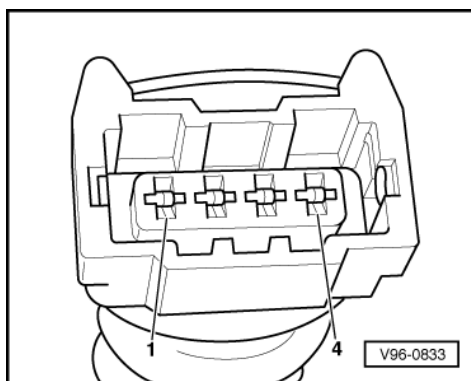
Test requirements:

Fuse -S32 OK.

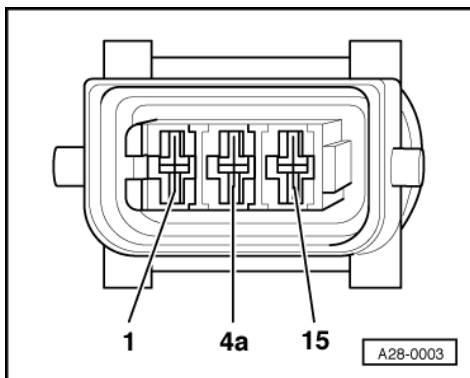
- Switch ignition on.
- -> Connect diode lamp between each contact of the 4-pin connector at the output stages and engine ground. The diode lamp must light up for all contacts.

Note:

The primary voltage supply is measured via fuse -S32 and the primary coil of the ignition coil.

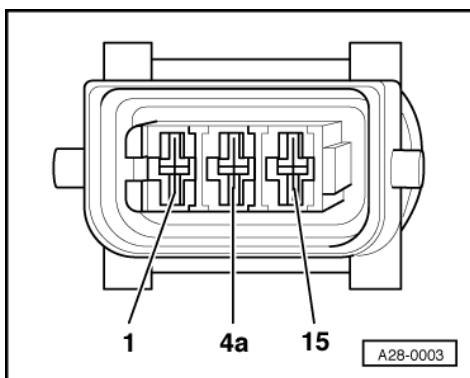


- -> If diode lamp does not light up, check for open circuit in wiring between 4-pin connector at output stage ...



- -> ... and contact 1 of relevant connector at ignition coil according to current flow diagram.

Contact on 4-pin connector	Contact 1 on connector for ignition coil, cylinder
Black	
1	1
2	2
3	3
4	4



- -> If no fault is present in this wiring, test for open circuit in wiring between contact 15 of connector for relevant ignition coil and fuse -S32 and in voltage supply to fuse according to current flow diagram.

Notes:

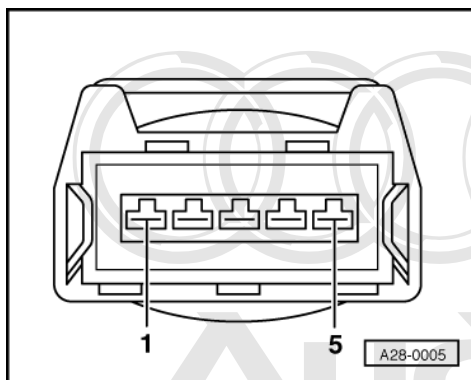
- ♦ A measurement of the primary resistance of the ignition coils is not normally necessary when using this test method (primary resistance about 0.4 ... 0.6 ω , measured between contact 1 and 15 of ignition coil).
- ♦ A high voltage blocking diode is installed in the secondary circuit of the ignition coil. For this reason, it is not possible to carry out a resistance measurement of the secondary coil using conventional testers.

4.4 - Checking output stages for ignition coils

Checking actuation of power output stages

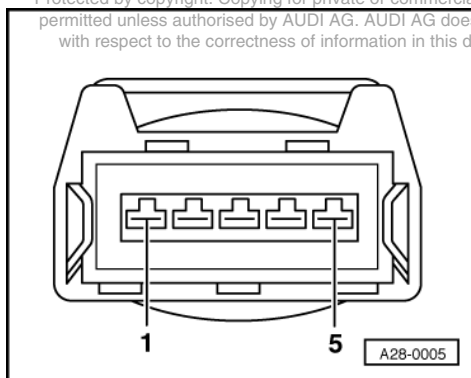
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- Disconnect the connectors from the power output stage.
- Disconnect the connectors from all the injectors.

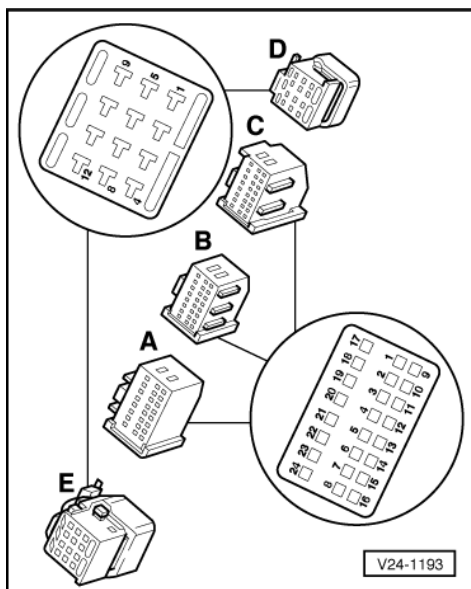


- -> Connect the diode lamp in turn between contacts 1, 2, 4 and 5 of the 5-pin connector and engine ground and operate the starter for a few seconds in each case. The diode test lamp should flash each time.

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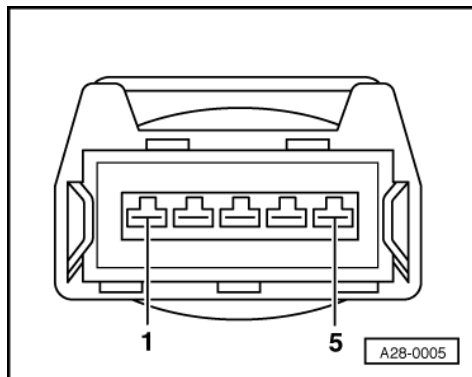
- If the diode test lamp does not flash, connect test box V.A.G1598/19 to the wiring harness for Motronic control unit -J220.
- -> Test wiring from 5-pin connector at output stage ...



- -> ... to Motronic control unit -J220 for open circuit and short to positive or ground according to current flow diagram.

Contact on 5-pin connector	Test box V.A.G 1598/19 or - J220
1	B6

Contact on 5-pin connector	Test box V.A.G 1598/19 or - J220
2	B13
4	B14
5	B5



- -> If the wiring to the Motronic control unit is OK, check ground wire from contact 3 of both 5-pin connectors to engine ground for continuity.
- If no faults are present in any of the wiring and the diode lamp has not flashed, renew the Motronic control unit.

Testing function of output stage

- Connect 5-pin connector at output stage.
- Connect a diode lamp between battery positive and one each of the contacts at the 4-pin output of the output stage and operate the starter for a few seconds in each case.
The diode test lamp should flash each time.
- If the diode test lamp does not flash in the case of one or several outputs, replace the power output stage.

Note:

Diode test lamps with very low current consumption already glow when the engine is not running and become brighter and darker during starting.

5 - Testing supply voltage of Motronic control unit

5.1 - Testing supply voltage of Motronic control unit

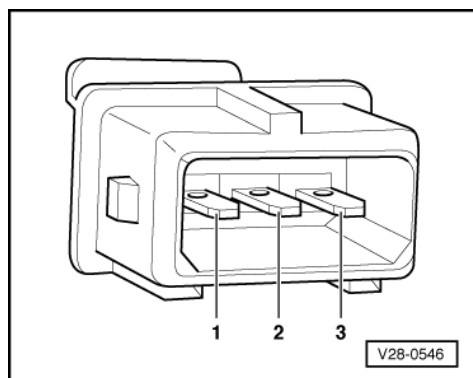
- Testing fuse -S32
- Connect test box V.A.G 1598/19 to the wiring harness of the Motronic control unit.
- Connect diode test lamp V.A.G 1527 to socket D9 (permanent positive) and in turn to sockets D11, D12, E11 and E12 (ground connections).
- The diode test lamp should light up each time.
- If the diode test lamp does not light up, check for open circuit in the wiring according to the current flow diagram and rectify any open circuit.
- Connect diode test lamp V.A.G 1527 to socket D11 (ground) and to socket D10 (ignition positive, terminal 15).
- Switch on ignition, the diode test lamp should come on.
- If the diode test lamp does not light up, check for open circuit in the wiring according to the current flow diagram and rectify any open circuit.



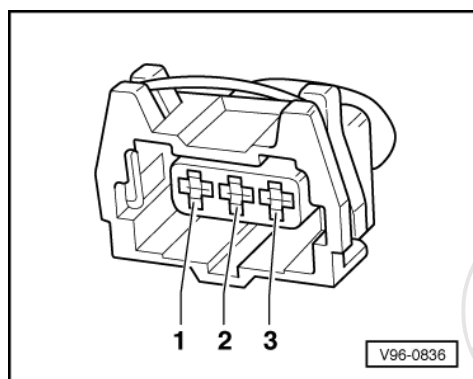
6 - Checking engine speed sender -G28

6.1 - Checking engine speed sender -G28

Installation position of sender and plug connection => Fitting locations overview, Page 50 .

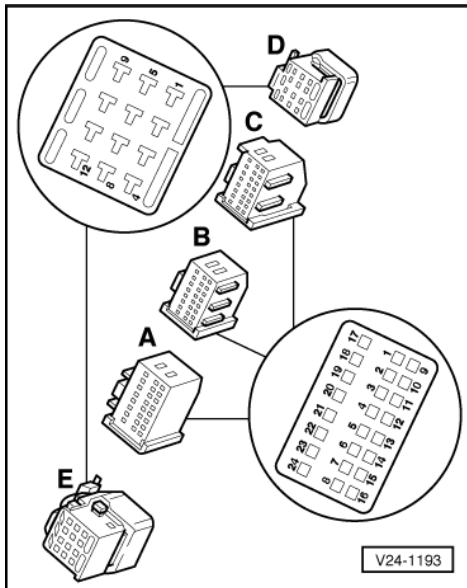


- Unplug the connector of the engine speed sender (identification: grey connector).
- -> Connect hand-held multimeter V.A.G 1526 for resistance measurement to contacts 1 and 2 using adapter cables from V.A.G 1594.
- Specified value: 480 ... 1000 Ω .
- If the value does not match the specified value, fit a new engine speed sender.
- If the specified value is obtained, connect an ohmmeter to contacts 1 and 3, plus to contacts 2 and 3.
- Specified value: infinite resistance (open circuit)
- If the value does not match the specified value, fit a new engine speed sender.



- If the specified values are met, check the wiring between the sender connector and the Motronic control unit as follows:
- Connect test box V.A.G 1598/19 to the wiring harness of the Motronic control unit.
- -> Check for open circuit and short to ground or positive in wiring from sender connector ...

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- -> ... to Motronic control unit -J220 according to current flow diagram.

Contact on sender connector	Test box V.A.G 1598/19 or - J220
1	B16
2	B15
3	D11 (ground)

- If none of the tests up to this point have revealed a fault, replace the Motronic control unit.

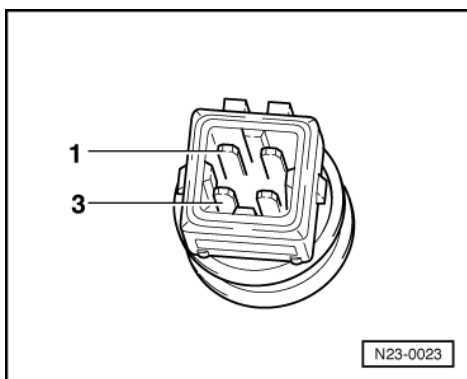
7 - Checking coolant temperature sender -G62

7.1 - Checking coolant temperature sender -G62

Note:

Sender -G62 is located in a shared housing with the sender for the instrument cluster -G2.

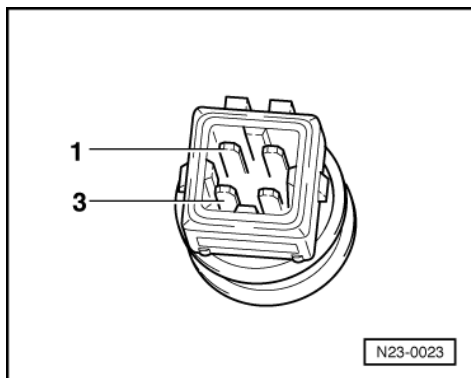
Fitting location of the coolant temperature sender => Fitting locations overview, Page 50



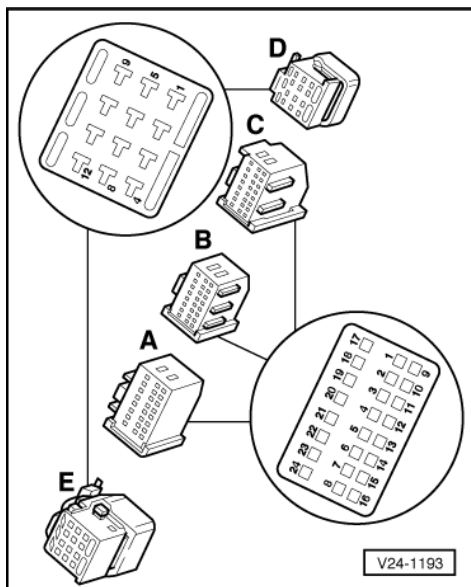
- ♦ Engine cooled down to room temperature (approx. 20 °C).



- Disconnect the connector from the coolant temperature sender.
- -> Connect hand-held multimeter V.A.G 1526 with adapter cables from V.A.G 1594 for resistance measurement to contacts 1 and 3 of the sender.
- Specified value: approx. 1,5 3.0 kohm.
- If the value does not match the specified value, fit a new sender.
- If the specified value is met, check the wiring between the sender and the Motronic control unit as follows:
- Connect test box V.A.G 1598/19 to the wiring harness of the Motronic control unit.



- -> Check for open circuit and short to ground or positive in wiring from 2-pin sender connector ...



- -> ... to Motronic control unit -J220 according to current flow diagram.

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Contact on 2-pin connector	Test box V.A.G 1598/19 or -J220
1 (signal)	A5
3 (reference ground)	A15

- If none of the tests up to this point have revealed a fault, replace the Motronic control unit.

Checking coolant temperature sensor

Notes:

- ♦ The coolant temperature sender is a temperature-sensitive resistor. If the sender signal is biased, for example due to moisture in a connector (effect similar to parallel resistor), this biasing may be in a range which the control unit is still not able to detect.
- ♦ If a fault regarding the coolant temperature sender is stored, a substitute value derived from the intake air temperature is displayed in the measured value block for a time determined by the control unit. After this time has elapsed a substitute value for a warm engine is used.
- Interrogate and delete fault memory => Page 4.
- Read measured value block (function 08) and select Display group 03 => Page 19.
- Check display in Display zone 3.
The coolant temperature is displayed in °C.

Note:

If the engine has cooled down to room temperature, then the coolant temperature is in the range of the ambient temperature immediately after the start and rises as the engine warms up.

- If a coolant temperature is displayed which appears implausible compared to the ambient temperature or the temperature of the engine as it starts to warm up, even though no fault is stored, check the wiring for short circuit to itself and other wiring (bypass, e.g. due to moisture in connectors).
- If none of the tests up to this point have revealed a fault, try replacing the coolant temperature sender.
- If the fault is still present after replacing the coolant temperature sender, replace the Motronic control unit.

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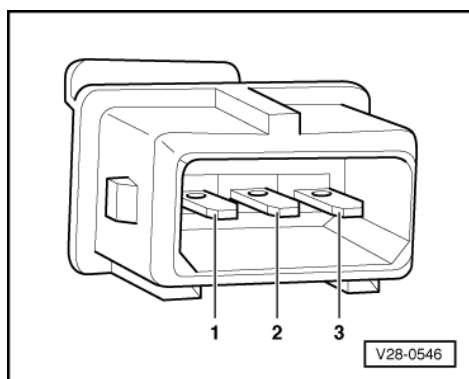
8 - Checking knock senders -G61 and -G66

8.1 - Checking knock senders -G61 and -G66

On ADP engines only one knock sensor is fitted (-G61).

Notes:

- ♦ It is not possible to carry out an electrical test of the knock sensors themselves.
- ♦ Interrogate fault memory => Page 4.
- ♦ Read measured value block, Display groups 15 and 16 => Page 38
- ♦ To ensure that the knock sensors function properly it is important to keep exactly to the specified tightening torque of 20 Nm.
- ♦ Check plug connection from knock sensor to wiring harness for corrosion (plug connections are located behind the coolant expansion tank).
- Connect test box V.A.G 1598 with adapter cable V.A.G 1598/19 to the wiring harness for the Motronic control unit.
- Disconnect the plug for the relevant knock sensor (behind coolant expansion tank).



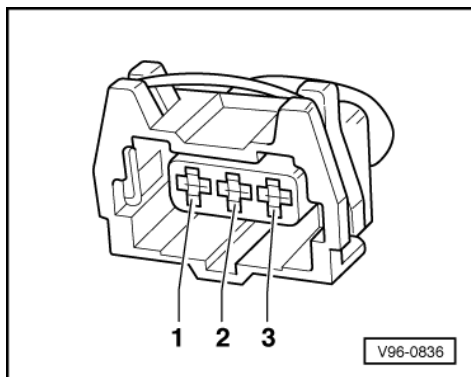
- -> Check all three contacts on the knock sensor connector for short circuit to each other using an ohmmeter. There must be no connection between any of the wires.



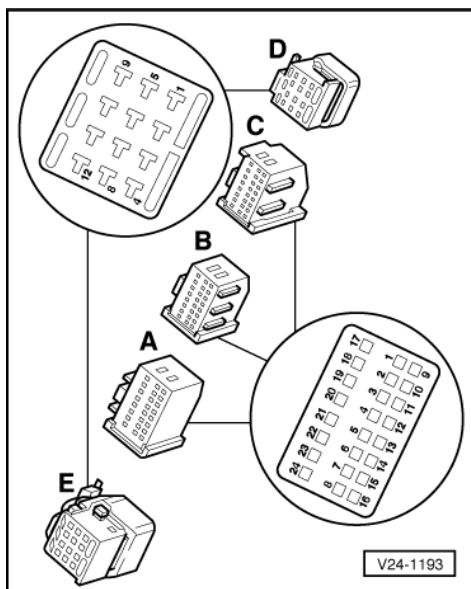
- If there is a connection between the contacts, fit a new knock sensor.

Testing wiring from knock sensor to Motronic control unit

- Connect test box V.A.G 1598/19 to the wiring harness of the Motronic control unit.



- -> Check wiring from the relevant sensor connector ...



- -> ... to Motronic control unit -J220 for open circuit and short to positive or ground according to current flow diagram.

Contact on sender connector	Test box V.A.G 1598/19 or - J220
-G61 1 2 3	A8 (signal) A15 (reference ground) D11 (screening to ground)
-G66 1 2 3	A16 (signal) A15 (reference ground) D11 (screening to ground)

Note:

Use only gold plated contacts when repairing the contacts in the plug connectors for the knock sensors.

9 - Checking Hall sender -G40

9.1 - Checking Hall sender -G40

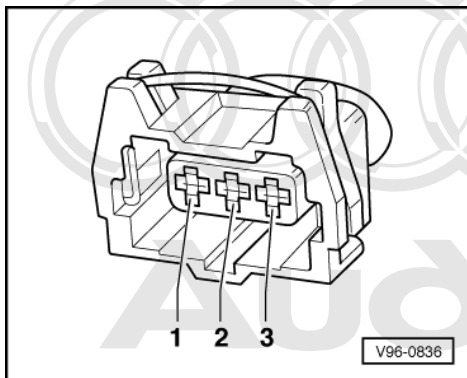
The Hall sender is located in the distributor on ADP engines and on ADR / AEB engines at the front of the cylinder head, see Fitting locations overview => Page 50.

Notes:

- ◆ In normal operation the engine control unit recognises the ignition position for cylinder 1 from the Hall sender signal
- ◆ If no Hall sender signal is received, the knock sensor signals can no longer be assigned to the cylinders. If this happens, the knock control system is deactivated and the ignition timing is slightly retarded in order to prevent knocking.
- ◆ In the event of failure of the Hall sender all three engine variants continue to run and can also be re-started for the following reasons:

The fact that the control unit is out of phase by one engine revolution does not have any noticeable effect on the injection system. If this happens, the fuel is injected "upstream" (before the closed inlet valve) instead of while the inlet valve is open. This has only a minor influence on the quality of the air/fuel mixture.

- With the distributor system of the ADP engine the cylinder allocation takes place mechanically via the distributor.
- With the double spark system of the ADR engine, there is a spark for each cylinder on every engine revolution (and not just on every second revolution as is otherwise normal).
- On the ignition system of the AEB engine with four individual ignition coils, the Motronic control unit triggers a spark on every cylinder for every revolution of the engine once this fault has been detected.

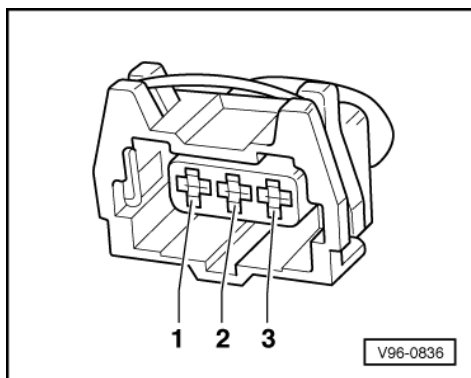


- Push back rubber grommet at connector of the Hall sender (the connector remains plugged in at the sender).
- Connect diode test lamp V.A.G 1527 from rear between contacts 1 and 2.

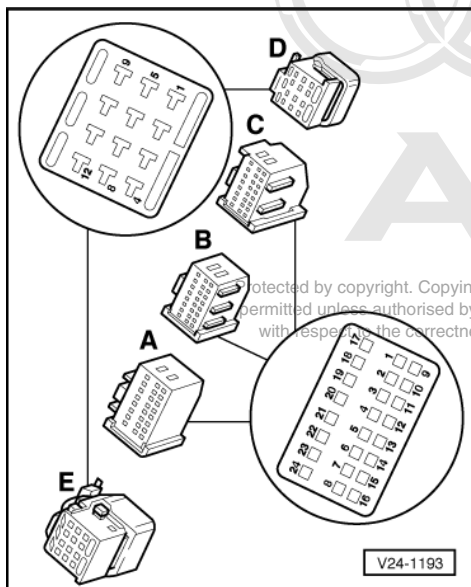
Note:

Receptacles are numbered accordingly on the back of the connector.

- Operate starter for a few seconds.
- The diode test lamp must flash briefly on each second engine revolution.
- Pull connector off Hall sender.
- Switch ignition on.
- Connect hand-held multimeter V.A.G 1526 to contacts 1 and 3 of the connector of the Hall sender..
- Specified value: 4.5 ... 5.5 V
- Connect hand-held multimeter V.A.G 1526 to contacts 2 and 3 of the connector of the Hall sender..
- Specified value: Battery voltage



- If the specified values are achieved and the diode test lamp does not flash, replace the Hall sender.
- If the specified values are not achieved test the wiring as follows:
- Connect test box V.A.G 1598/19 to the wiring harness of the Motronic control unit.
- -> Check the wiring from the Hall sensor



- -> ... to Motronic control unit -J220 for open circuit and short to positive or ground according to current flow diagram.

Contact on connector for Hall sensor	Test box V.A.G 1598/19 or - J220
1	A3 (positive, 5 V)
2	B2 (signal)
3	A15 (ground from control unit)

- If a trial erasure of the fault memory is followed by the replaced indication of a fault relating to the camshaft sensor (Hall sender) although all previous tests were OK, the following faults are possible:
 - ADP engine
 - Distributor rotated or incorrectly fitted.
 - Test and adjust basic setting => Page 98 .
 - ADR or AEB engine
 - rotor ring for Hall sender rotated.
- Unbolt the Hall sensor, then check to ensure that the rotor ring is correctly aligned on the camshaft.(if it is incorrectly installed, the catch will be pressed flat when the securing screw is tightened).
- If the position of rotor ring is OK, check the position of the camshaft in relation to the crankshaft.

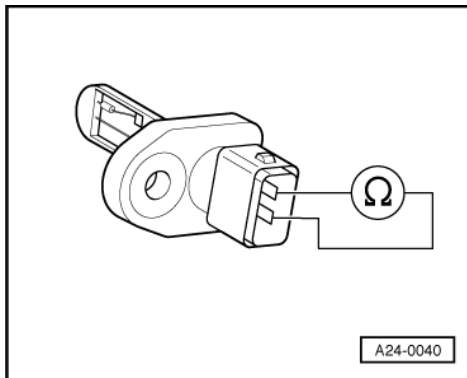
=> 4-cylinder engine, Mechanics; Repair Group 13; Dismantling and reassembling engine; Removing and installing toothed belt, tensioning. Dismantling and reassembling engine Removing and installing toothed belt, tensioning.

Note on signal testing with an oscilloscope:

The centre point of the window of the Hall sender must lie on the third falling flank of the engine speed signal after the reference mark gap.

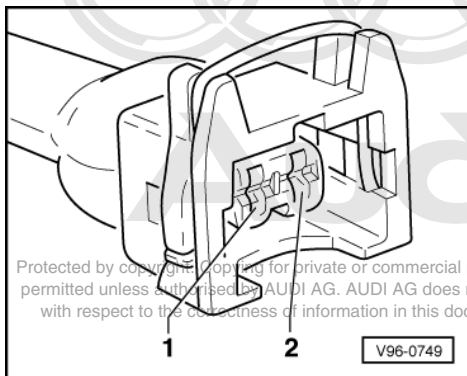
10 - Testing intake air temperature sender -G42 (AEB engine only)

10.1 - Testing intake air temperature sender -G42 (AEB engine only)

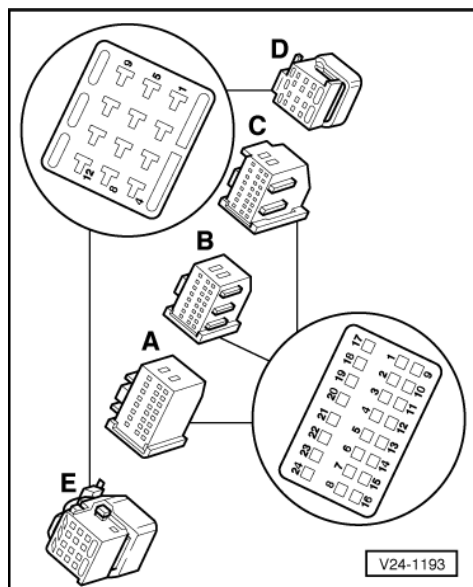


Fitting location of intake air temperature sender, see Fitting locations overview, => Page 54 .

- ♦ Engine cooled down to room temperature (approx. 20 °C).
- Disconnect the connector from the intake air temperature sender.
- -> Connect ohmmeter to intake air temperature sender.
- Specified value: approx. 1,6 ... 2,8 kΩ.
- If the value does not match the specified value, fit a new intake air temperature sender.



- If the specified value is met, check the wiring between the sender connector and the Motronic control unit as follows:
- Connect test box V.A.G 1598/19 to the wiring harness of the Motronic control unit.
- -> Check for open circuit and short to ground or positive in wiring from 2-pin sender connector ...



- -> ... to Motronic control unit -J220 according to current flow diagram.

Contact on 2-pin connector	Test box V.A.G 1598/19 or - J220
1	A2
2	A15

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- If none of the tests up to this point have revealed a fault, replace the Motronic control unit.